United States
Department of
Agriculture

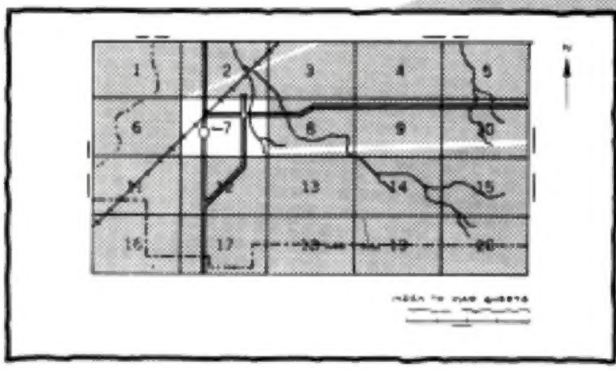
Soil
Conservation
Service

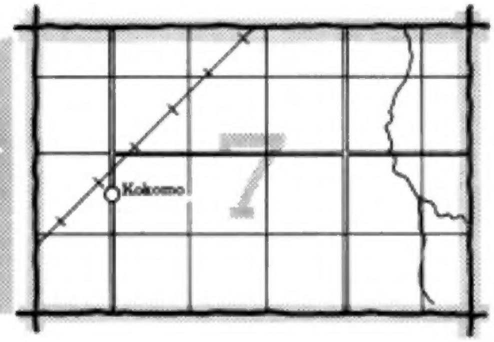
In cooperation with
Iowa Agriculture and
Home Economics
Experiment Station;
Cooperative Extension
Service, Iowa State
University; and Department
of Soil Conservation,
State of Iowa

Soil Survey of Washington County, Iowa

HOW TO USE

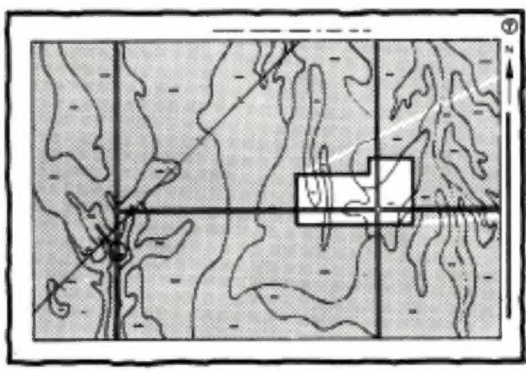
1. Locate your area of interest on the "Index to Map Sheets"

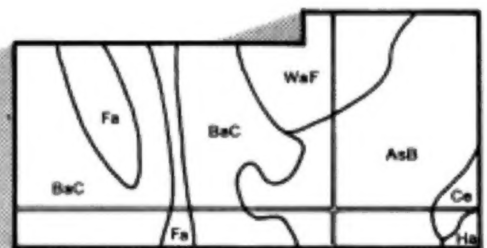




2. Note the number of the map sheet and turn to that sheet.

3. Locate your area of interest on the map sheet.





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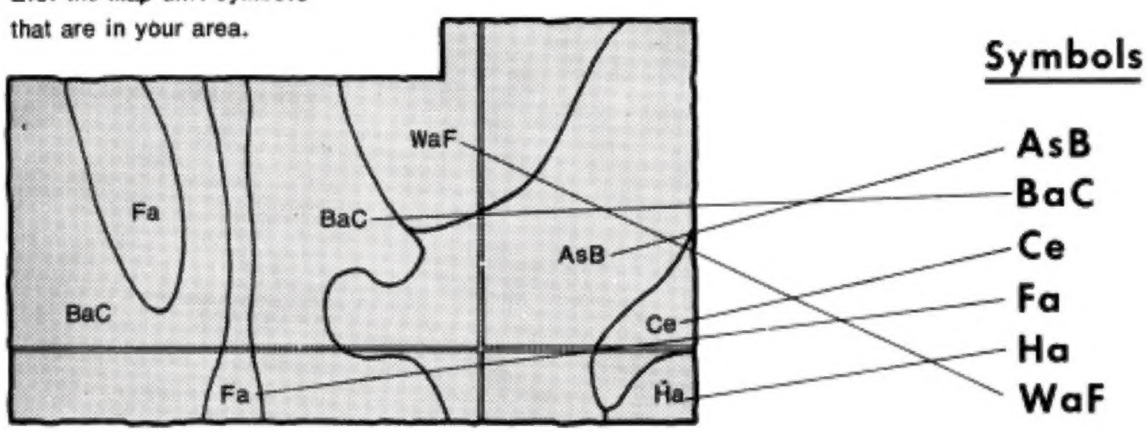
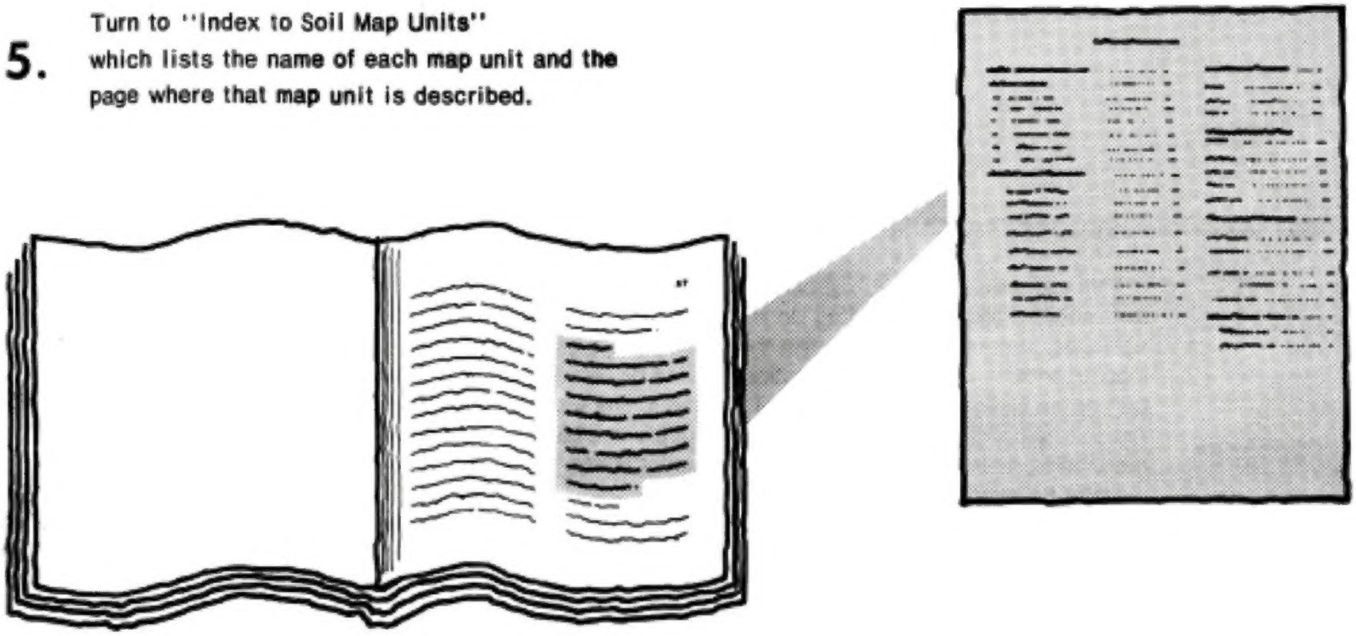
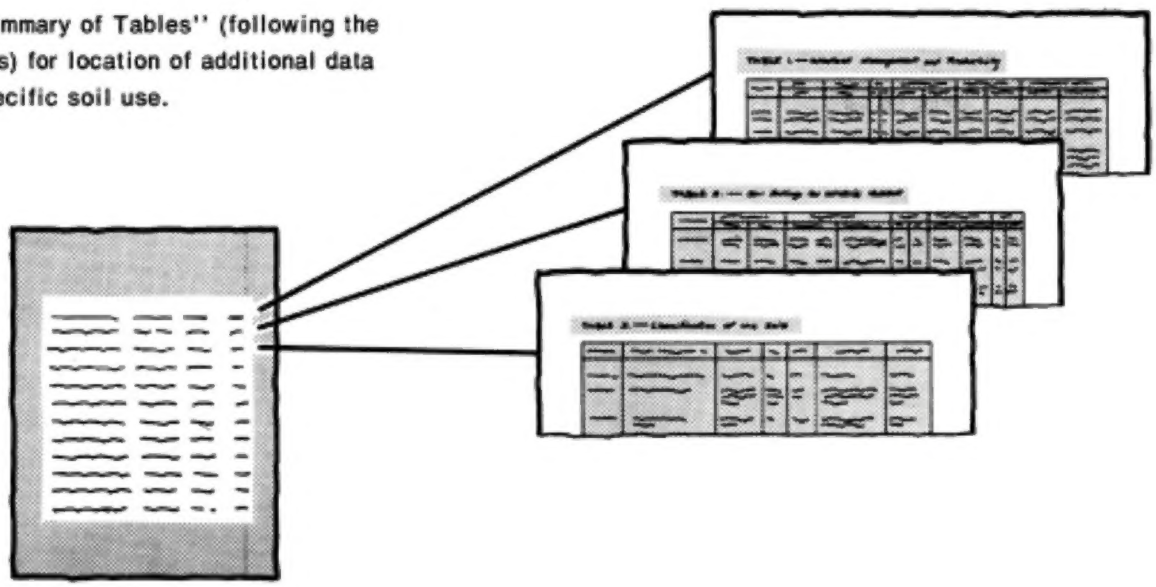


THIS SOIL SURVEY

5. Turn to "Index to Soil Map Units" which lists the name of each map unit and the page where that map unit is described.



6. See "Summary of Tables" (following the Contents) for location of additional data on a specific soil use.



7. Consult "Contents" for parts of the publication that will meet your specific needs. This survey contains useful information for farmers or ranchers, foresters or agronomists; for planners, community decision makers, engineers, developers, builders, or homebuyers; for conservationists, recreationists, teachers, or students; to specialists in wildlife management, waste disposal, or pollution control.

This soil survey is a publication of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other federal agencies, state agencies including the Agricultural Experiment Stations, and local agencies. The Soil Conservation Service has leadership for the federal part of the National Cooperative Soil Survey. In line with Department of Agriculture policies, benefits of this program are available to all, regardless of race, color, national origin, sex, religion, marital status, or age.

Major fieldwork for this soil survey was performed in the period 1978 to 1983. Soil names and descriptions were approved in 1983. Unless otherwise indicated, statements in this publication refer to conditions in the survey area in 1983. This survey was made cooperatively by the Soil Conservation Service; the Iowa Agriculture and Home Economics Experiment Station; the Cooperative Extension Service, Iowa State University; and the Department of Soil Conservation, State of Iowa. It is part of the technical assistance furnished to the Washington County Soil Conservation District. Funds appropriated by Washington County were used to defray part of the cost of the survey.

Soil maps in this survey may be copied without permission. Enlargement of these maps, however, could cause misunderstanding of the detail of mapping. If enlarged, maps do not show the small areas of contrasting soils that could have been shown at a larger scale.

Cover: An area of Inton silt loam, 5 to 9 percent slopes, moderately eroded, used for soybeans. Contour farming and grass back-slope terraces help to control further erosion in this area.

Contents

Soil Series

Issued November 1986

Index to Map Units

Summary of Tables

Preface

This soil survey contains information that can be used in land-planning programs in Washington County, Iowa. It contains predictions of soil behavior for selected land uses. The survey also highlights limitations and hazards inherent in the soil, improvements needed to overcome the limitations, and the impact of selected land uses on the environment.

This soil survey is designed for many different users. Farmers, foresters, and agronomists can use it to evaluate the potential of the soil and the management needed for maximum food and fiber production. Planners, community officials, engineers, developers, builders, and home buyers can use the survey to plan land use, select sites for construction, and identify special practices needed to ensure proper performance. Conservationists, teachers, students, and specialists in recreation, wildlife management, waste disposal, and pollution control can use the survey to help them understand, protect, and enhance the environment.

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are shallow to bedrock. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

These and many other soil properties that affect land use are described in this soil survey. Broad areas of soils are shown on the general soil map. The location of each soil is shown on the detailed soil maps. Each soil in the survey area is described. Information on specific uses is given for each soil. Help in using this publication and additional information are available at the local office of the Soil Conservation Service or the Cooperative Extension Service.

Soil Survey of
Washington County, Iowa

By J. Herbert Wilson, Soil Conservation Service

Fieldwork by Don A. Baloun, Tom Brantmeier, Asghar Chowdhery, Mark R. LaVan, William N. Mulder, Edward J. Schermerhorn, Paul P. Viner, Neal D. Williamson, and J. Herbert Wilson, Soil Conservation Service

United States Department of Agriculture, Soil Conservation Service,
in cooperation with
the Iowa Agriculture and Home Economics Experiment Station;
the Cooperative Extension Service, Iowa State University;
and the Department of Soil Conservation, State of Iowa

WASHINGTON COUNTY is in the southeastern part of Iowa (fig. 1). It has an area of 363,520 acres, or about 568 square miles. Washington, the county seat, is in the central part of the county, about 101 miles southeast of Des Moines.

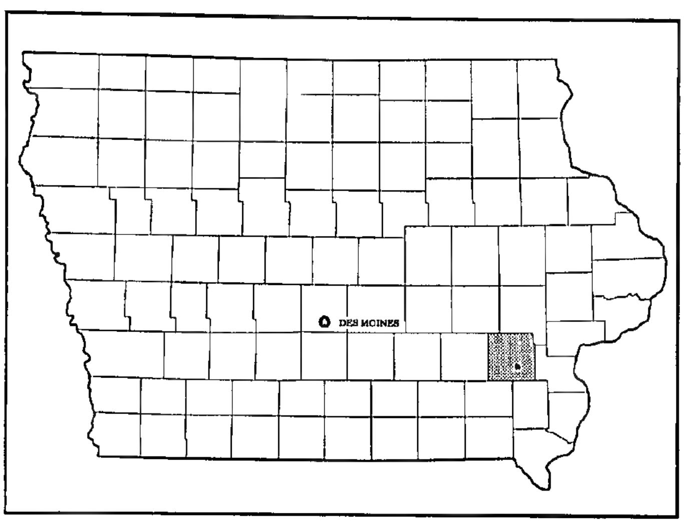


Figure 1.—Location of Washington County in Iowa.

This survey updates the soil survey of Washington County published in 1930 (*13*). It provides additional information and larger maps, which show the soils in more detail.

General Nature of the County

Don Baloun, soil conservationist, Soil Conservation Service, prepared this section.

The paragraphs that follow describe the history and development of the county, transportation facilities, relief and drainage, natural resources, agriculture, and climate.

History and Development

Much of the information in this section is derived from a history of the county published in 1880 (*21*). In the 1700's and early 1800's, Indians ruled in Iowa. They subsisted on the wild animals then inhabiting the county, mainly wild turkeys, deer, fish, and muskrats. Indian corn was cultivated in a few patches. It furnished scanty food during part of the year.

On September 1, 1832, the Black Hawk Purchase was signed by the Sac and Fox Indians and the U.S. Government. This purchase involved a large portion of Iowa and included all of Washington County, except for the northwestern part. The purchase allowed settlers to move farther west. As a result of this peaceable arrangement and the earnest efforts of the government

to carry out the provisions of treaties, the early settlers of Washington County experienced none of the hardships undergone by many of the settlers in other parts of the country. The Indians seldom, if ever, caused disturbances after the early settlers came into possession of the land.

Settlement did not begin until 1836. During the early years of settlement, the county was part of a county in Wisconsin then known as Slaughter County. It was renamed Washington County on January 25, 1838.

The first census of the county showed a population of 300. In 1840, the first court house was built in Washington, marking the beginning of organized government in the county. The first railroad entered the county in September 1858. It ran from Muscatine to Washington. Because of the railroad and the location of the county, the population rapidly increased between 1840 and 1880, when it was 20,500. It has decreased slightly since the late 1800's. In 1970, it was 18,967. In 1980, it was 20,141. Washington, the largest town in the county, has a population of 6,584 (*6*).

Transportation Facilities

U.S. Highway 218 runs north and south through the eastern part of Washington County. State Highway 1 runs dominantly north and south through the center of the county. State Highway 22 runs east and west through the northern part, and State Highway 92 runs east and west through the center. These routes are connected to all parts of the county by roads surfaced with concrete, asphalt, or crushed rock.

Washington is along a major railway. Almost all the other railroad lines that have serviced other communities in the county have been abandoned. Washington has a small municipal airport with lighted runways. Wellman and Kalona have small private airports. Bus transportation is available in Washington. Motor freight lines serve all trading centers in the county.

Relief and Drainage

Washington County is characterized by an eroded glacial drift plain modified by a deep mantle of loess. Relief ranges from nearly level on upland divides to very steep on the hilly and broken land bordering the major watercourses. The most extensive nearly level upland area extends diagonally southeastward across the county. Since tributaries of the major streams do not heavily dissect this upland divide, drainage systems are needed to remove excess water. The remaining area of the county is thoroughly dissected, allowing for easy removal of excess water.

The county is dissected by two major river systems—the English River in the north and the Skunk River in the southwest. The English River is a tributary to the Iowa River, which borders the northeast corner of the county. Other tributaries of the Iowa River that flow in Washington County are Davis, Whiskey Run, Goose, Long, and Slough Creeks. Along with the English River, these creeks drain the northern and eastern parts of the county. The southern and western parts are drained by the Skunk River and its tributaries, including Crooked, Williams, Walnut, Indian, Dutch, and Honey Creeks. Wide, nearly level areas of bottom land are on both sides of the major rivers and streams.

The highest elevation in the county, about 800 feet above sea level, is near Keota. Washington, Havre, and Crawfordsville have elevations of 769, 733, and 700 feet, respectively. These elevations tend to indicate that the general slope is to the south and east along the upland divide. The lowest elevation, about 600 feet above sea level, is in an area near Coppock along the Skunk River, in the southern part of the county.

Natural Resources

Washington County has natural resources other than its rich agricultural land. Among these are limestone, sand, gravel, and trees.

Limestone and sandstone are in scattered areas throughout the county. These areas are adjacent to the English, Iowa, and Skunk Rivers and their tributaries. Some of the limestone has been crushed and used commercially for road building, for concrete, and as a source of agronomic lime. Some has been used as decorative stone and flagstone.

Deposits of sand and gravel are within the terraces adjacent to the English and Iowa Rivers and their tributaries. Only a few pits have been excavated. The sand and gravel can be used for road surfacing and as concrete aggregate.

Trees in Washington County have commercial importance as well as esthetic value. A few small sawmills harvest native oak and walnut trees. The trees provide picturesque scenery for boaters, fishermen, and others. The abundant wildlife that inhabit the county rely on the trees for dens and cover.

Agriculture

The farms in Washington County, like those throughout the country, have been increasing in size and decreasing in number. The number decreased from 1,406 in 1970 to 1,260 in 1982 (*5*). The size increased from 242 to 276 acres during this period. In 1880, the average size was 125 acres (*13*).

Agriculture in the county centers on grain crop production and mixed livestock. In 1981, corn was planted on about 152,000 acres. It was harvested for grain on 149,000 acres and for silage on 2,200 acres. The average corn grain yield was 136.8 bushels per acre. Soybeans were grown on about 69,700 acres. Of the acreage, 69,500 acres was harvested for beans. The average soybean yield was 47.0 bushels per acre. Hay

and oats were grown on 21,400 and 9,700 acres, respectively (*5*).

The most extensive livestock in the county is hogs. In 1980, about 520,000 hogs were marketed. That number was the fourth largest in Iowa (*5*). In 1982, the county had 51,000 cattle and calves, including 18,600 beef cattle on farms and 1,200 milk cows. About 18,000 grain-fed cattle were marketed in 1981. The number of sheep and lambs was about 7,200 in 1982. In 1981, the county had about 210,000 hens and pullets and 457,635 turkeys (*5*).

Climate

Prepared by the National Climatic Center, Asheville, North Carolina.

Table 1 gives data on temperature and precipitation for the survey area as recorded at Washington in the period 1951 to 1979. Table 2 shows probable dates of the first freeze in fall and the last freeze in spring. Table 3 provides data on length of the growing season.

In winter the average temperature is 25 degrees F, and the average daily minimum temperature is 16 degrees. The lowest temperature on record, which occurred at Washington on January 12, 1974, is -23 degrees. In summer the average temperature is 74 degrees, and the average daily maximum temperature is 86 degrees. The highest recorded temperature, which occurred at Washington on July, 1, 1956, is 105 degrees.

Growing degree days are shown in table 1. They are equivalent to "heat units." During the month, growing degree days accumulate by the amount that the average temperature each day exceeds a base temperature (50 degrees F). The normal monthly accumulation is used to schedule single or successive plantings of a crop between the last freeze in spring and the first freeze in fall.

The total annual precipitation is about 34 inches. Of this, 23 inches, or nearly 70 percent, usually falls in April through September. The growing season for most crops falls within this period. In 2 years out of 10, the rainfall in April through September is less than 18 inches. The heaviest 1-day rainfall during the period of record was 6.58 inches at Washington on August 25, 1951. Thunderstorms occur on about 50 days each year, and most occur in spring.

The average seasonal snowfall is about 25 inches. The greatest snow depth at any one time during the period of record was 32 inches. On the average, 32 days of the year have at least 1 inch of snow on the ground. The number of such days varies greatly from year to year.

The average relative humidity in midafternoon is about 60 percent. Humidity is higher at night, and the average at dawn is about 80 percent. The sun shines 75 percent of the time possible in summer and 50 percent in winter. The prevailing wind is from the northwest. Average windspeed is highest, 12 miles per hour, in spring.

How This Survey Was Made

This survey was made to provide information about the soils in the survey area. The information includes a description of the soils and their location and a discussion of the suitability, limitations, and management of the soils for specified uses. Soil scientists observed the steepness, length, and shape of slopes; the general pattern of drainage; the kinds of crops and native plants growing on the soils; and the kinds of bedrock. They dug many holes to study the soil profile, which is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biologic activity.

The soils in the survey area occur in an orderly pattern that is related to the geology, the landforms, relief, climate, and the natural vegetation of the area. Each kind of soil is associated with a particular kind of landscape or with a segment of the landscape. By observing the soils in the survey area and relating their position to specific segments of the landscape, a soil scientist develops a concept, or model, of how the soils were formed. Thus, during mapping, this model enables the soil scientist to predict with considerable accuracy the kind of soil at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, acidity, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. The system of taxonomic classification used in the United States is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpreted the data from these analyses and tests as well as the field-observed characteristics and the soil properties in terms of expected behavior of the soils under different uses. Interpretations for all of the soils were field tested through observation of the soils in different uses under different levels of management. Some interpretations are modified to fit local conditions, and new interpretations sometimes are developed to meet local needs. Data were assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management were assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can state with a fairly high degree of probability that a given soil will have a high water table within certain depths in most years, but they cannot assure that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Map Unit Composition

A map unit delineation on a soil map represents an area dominated by one major kind of soil or an area dominated by several kinds of soil. A map unit is identified and named according to the taxonomic classification of the dominant soil or soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural objects. In common with other natural objects, they have a characteristic variability in their properties. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of soils of other taxonomic classes. Consequently, every map unit is made up of the soil or soils for which it is named and some soils that belong to other taxonomic classes. These latter soils are called inclusions or included soils.

Most inclusions have properties and behavioral patterns similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting (similar) inclusions. They may or may not be mentioned in the map unit descriptions. Other inclusions, however, have properties and behavior divergent enough to affect use or require different management. These are contrasting (dissimilar) inclusions. They generally occupy small areas and cannot be shown separately on the soil maps because of the scale used in mapping. The inclusions of contrasting soils are mentioned in the map unit descriptions. A few inclusions may not have been observed and consequently are not mentioned in the descriptions, especially where the soil pattern was so complex that it was impractical to make enough observations to identify all of the kinds of soil on the landscape.

The presence of inclusions in a map unit in no way diminishes the usefulness or accuracy of the soil data. The objective of soil mapping is not to delineate pure taxonomic classes of soils but rather to separate the landscape into segments that have similar use and management requirements. The delineation of such landscape segments on the map provides sufficient information for the development of resource plans, but onsite investigation is needed to plan for intensive uses in small areas.

General Soil Map Units

The general soil map at the back of this publication shows the soil associations in this survey area. Each association has a distinctive pattern of soils, relief, and drainage. Each is a unique natural landscape. Typically, an association consists of one or more major soils and some minor soils. It is named for the major soils. The soils making up one association can occur in another but in a different pattern.

The general soil map can be used to compare the suitability of large areas for general land uses. Areas of suitable soils can be identified on the map. Likewise, areas where the soils are not suitable can be identified.

Because of its small scale, the map is not suitable for planning the management of a farm or field or for selecting a site for a road or building or other structure. The soils in any one association differ from place to place in slope, depth, drainage, and other characteristics that affect management.

Soil Descriptions

1. Mahaska-Taintor-Kalona Association

Nearly level, somewhat poorly drained and poorly drained, silty soils formed in loess on uplands

This association consists of soils on moderately broad and broad upland divides. The soils formed in thick loess, which is underlain by glacial till. Slopes range from 0 to 2 percent.

This association makes up about 16 percent of the county. It is about 43 percent Mahaska soils, 36 percent Taintor soils, 15 percent Kalona soils, and 6 percent soils of minor extent (fig. 2).

The somewhat poorly drained Mahaska soils are on slightly convex slopes on moderately broad upland flats. They are slightly higher on the landscape than the Taintor and Kalona soils. The poorly drained Taintor and Kalona soils are on plane or slightly concave slopes on broad upland flats. Kalona soils are in the center of the flats, and Taintor soils are on the outer parts.

Typically, the surface layer of the Mahaska soils is black, friable silty clay loam about 8 inches thick. The subsurface layer is black and very dark grayish brown, firm silty clay loam about 9 inches thick. The subsoil to a depth of about 60 inches is firm silty clay loam. The upper part is dark grayish brown and light olive brown, the next part is light olive gray and mottled, the lower part is gray and mottled.

Typically, the surface layer of the Taintor soils is black, friable silty clay loam about 8 inches thick. The subsurface layer is black and very dark gray, firm silty clay loam about 14 inches thick. The subsoil is about 27 inches thick. The upper part is grayish brown and olive gray, firm silty clay and silty clay loam, and the lower part is olive gray and light olive gray, firm and friable silty clay loam. The substratum to a depth of about 60 inches is olive gray and light olive gray silty clay loam.

Typically, the surface layer of the Kalona soils is black, firm silty clay loam about 7 inches thick. The subsurface layer is black and very dark gray, firm silty clay loam about 12 inches thick. The subsoil is about 29 inches thick. The upper part is very dark grayish brown and dark grayish brown, firm silty clay, and the lower part is grayish brown and olive gray, mottled, firm silty clay loam. The substratum to a depth of about 60 inches is light olive gray and gray silty clay loam.

The minor soils in this association are the Colo, Sperry, and Zook soils. Colo and Zook soils have a surface layer that is thicker and darker than that of the major soils. They formed in alluvium in long, narrow upland drainageways. The very poorly drained Sperry soils have a light colored subsurface layer of silt loam. They are in slightly depressional areas on the broad upland divides.

The soils in this association are used for intensive row cropping. Soybeans and corn are the major crops. The principal management concern is drainage. Installing subsurface tile improves the timeliness of fieldwork. In some of the nearly level areas, however, locating suitable tile outlets is difficult. A system of conservation tillage that leaves crop residue on the surface during the winter helps to prevent excessive soil loss.

2. Otley-Nira Association

Gently sloping and moderately sloping, moderately well drained, silty soils formed in loess on uplands

This association consists of gently sloping soils on convex ridgetops and moderately sloping soils on side slopes that are dissected by drainageways. Slopes range from 2 to 9 percent.

This association makes up 18 percent of the county. It is about 50 percent Otley soils, 32 percent Nira soils, and 18 percent soils of minor extent (fig. 3).

Otley soils are on convex ridgetops and side slopes. Nira soils are on plane and convex side slopes, typically at the head of drainageways below the Otley soils.

Typically, the surface layer of the Otley soils is very dark brown and black, friable silty clay loam about 8 inches thick. The subsurface layer is black and very dark grayish brown, friable silty clay loam about 10 inches thick. The subsoil to a depth of about 60 inches is firm silty clay loam. The upper part is brown and mottled, and the lower part is mixed yellowish brown, light brownish gray, and strong brown.

Typically, the surface layer of the Nira soils is black and very dark gray, friable silty clay loam about 7 inches thick. The subsurface layer is very dark grayish brown, friable silty clay loam about 5 inches thick. The subsoil is mottled, friable silty clay loam about 31 inches thick. The upper part is brown, and the lower part is light brownish gray and grayish brown and has strong brown mottles. The substratum to a depth of about 60 inches is light brownish gray, mottled silt loam.

The minor soils in this association are the Adair, Clarinda, Colo, Shelby, and Zook soils. The somewhat poorly drained Adair soils occur as narrow bands on shoulder slopes below the Otley and Nira soils and above the Shelby soils. The poorly drained Clarinda soils formed in a gray, clayey paleosol on convex side slopes below the Otley and Nira soils. The poorly drained Colo and Zook soils formed in alluvium in long, narrow upland drainageways. The well drained Shelby soils formed in glacial till on convex side slopes below the Otley and Nira soils.

The soils in this association are used for intensive row cropping. Soybeans and corn are the major crops. The principal management concern is erosion. A system of conservation tillage that leaves crop residue on the surface, contour farming, and terraces help to prevent excessive soil loss.

3. Ladoga-Hedrick-Gara Association

Gently sloping to moderately steep, moderately well

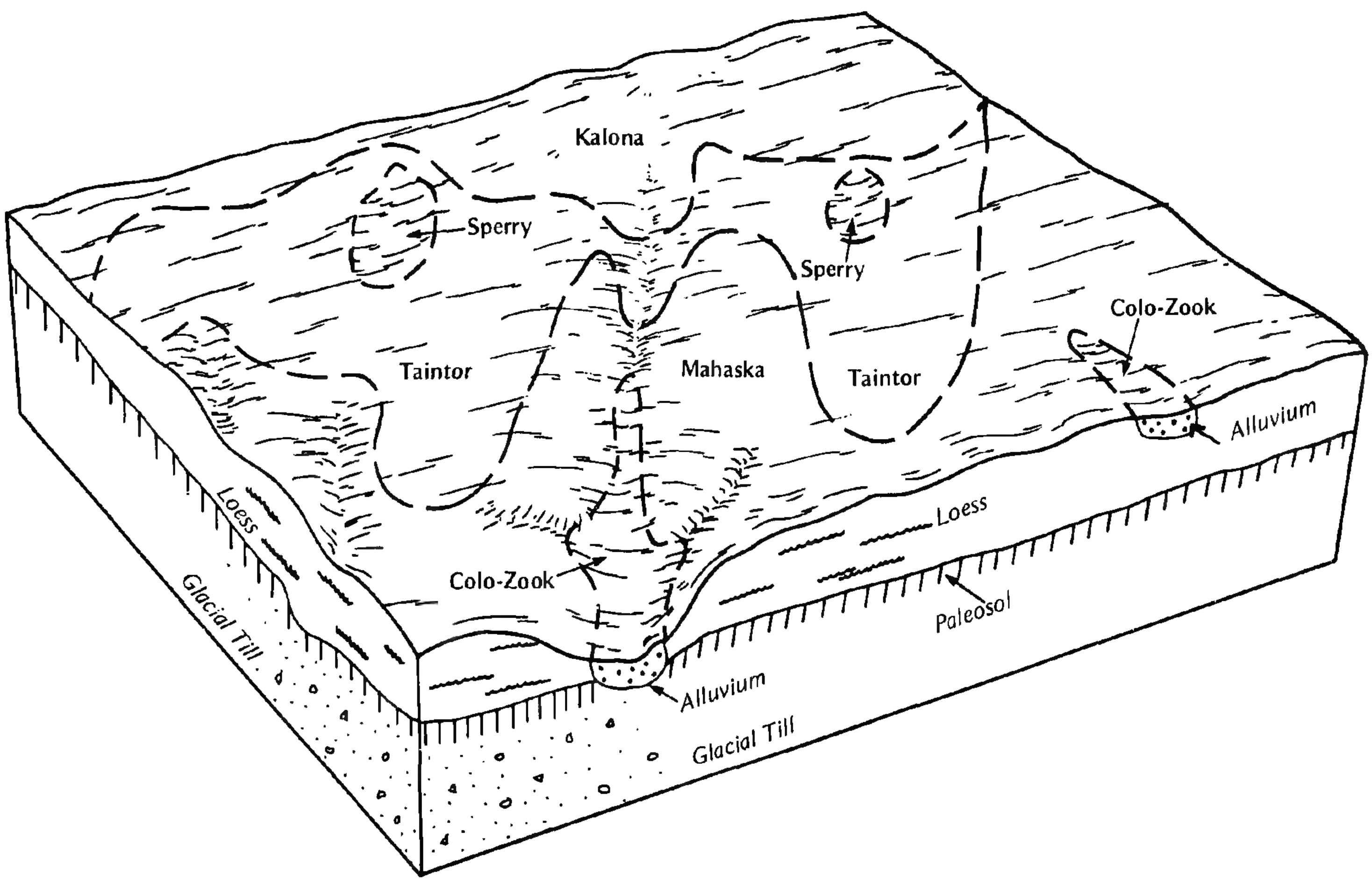


Figure 2.—Pattern of soils and parent material in the Mahaska-Taintor-Kalona association.

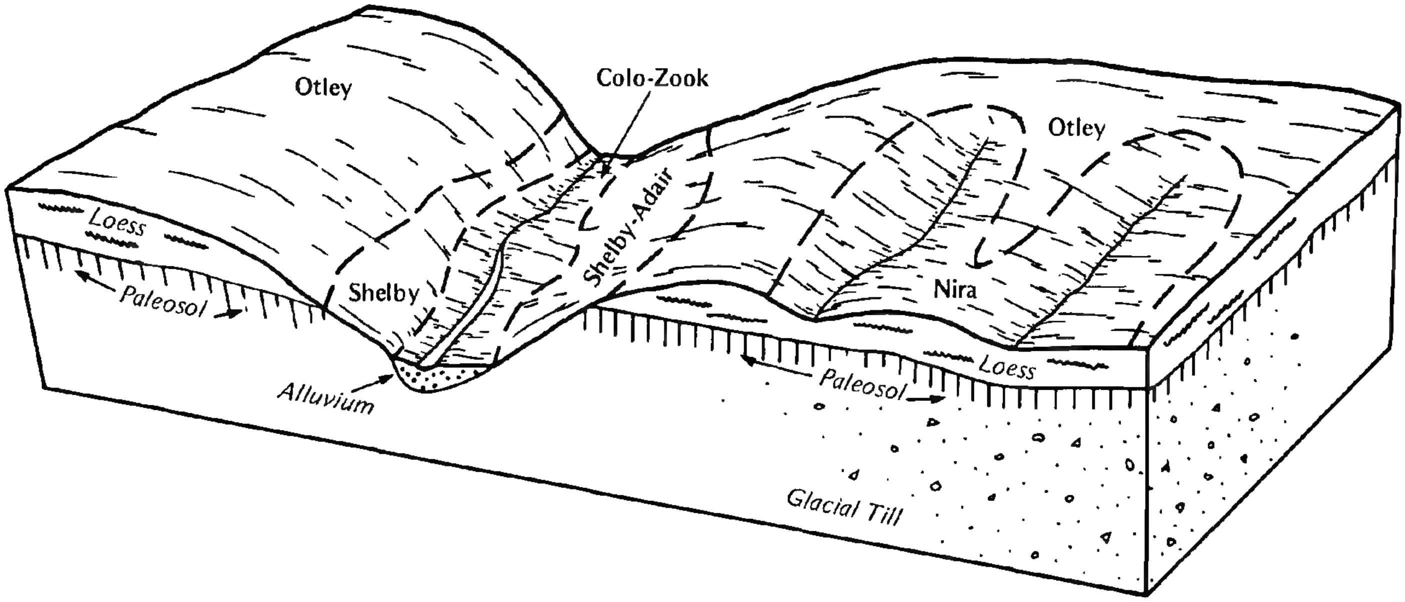


Figure 3.—Pattern of soils and parent material in the Otley-Nira association.

drained and well drained, silty and loamy soils formed in loess or glacial till on uplands

This association consists of soils that are highly dissected by drainageways and that are in areas bordering the upper ends of the major streams. The landscape is characterized by narrow, rounded ridgetops; long and short, convex side slopes; and many narrow valleys dissecting the uplands. Slopes range from 2 to 18 percent.

This association makes up about 29 percent of the county. It is about 30 percent Ladoga soils, 16 percent Hedrick soils, 10 percent Gara soils, and 44 percent soils of minor extent.

Ladoga soils are moderately well drained and are gently sloping to strongly sloping. They formed in loess on rounded ridgetops and convex side slopes. Hedrick soils are moderately well drained and are gently sloping and moderately sloping. They formed in loess on plane and convex side slopes, typically at the head of drainageways below the Ladoga soils. Gara soils are well drained and are strongly sloping and moderately steep. They formed in glacial till on convex side slopes below the Ladoga and Hedrick soils.

Typically, the surface layer of the Ladoga soils is very dark brown, friable silt loam about 8 inches thick. The subsoil is silty clay loam about 45 inches thick. The upper part is firm and is brown and dark yellowish brown, and the lower part is friable, is yellowish brown, and has grayish brown mottles. The substratum to a depth of about 60 inches is yellowish brown and light brownish gray, mottled silty clay loam.

Typically, the surface layer of the Hedrick soils is very dark grayish brown, friable silt loam about 8 inches thick. Because of plowing, it has some streaks and pockets of brown silty clay loam subsoil material. The subsoil is mottled silty clay loam about 45 inches thick. The upper part is dark yellowish brown, brown, and yellowish brown, has grayish brown mottles, and is firm. The lower part is light brownish gray, has strong brown mottles, and is friable. The substratum to a depth of about 60 inches is light brownish gray, mottled silty clay loam.

Typically, the surface layer of the Gara soils is very dark grayish brown, friable loam about 8 inches thick. Because of plowing, it generally has some streaks and pockets of brown subsoil material. The subsoil is about 43 inches thick. The upper part is brown, friable loam, and the lower part is yellowish brown, mottled, firm clay loam. The substratum to a depth of about 60 inches is yellowish brown, mottled clay loam.

The most extensive minor soils in this association are the Armstrong, Colo, Givin, and Zook soils. The somewhat poorly drained Armstrong soils formed in a paleosol derived from glacial till. They occur as narrow bands on shoulder slopes below the Ladoga and Hedrick soils. The poorly drained Colo and Zook soils formed in alluvium in long, narrow upland drainageways. The somewhat poorly drained, nearly level Givin soils are on narrow upland divides.

The soils in this association are used for diversified farming. In many of the more gently sloping areas, corn is grown year after year or in a rotation with soybeans. The more sloping areas are better suited to hay, pasture, and timber than to row crops. Most areas are not suited

to intensive row cropping because of the slope and the erosion hazard. The principal management concerns are erosion, low fertility in the subsoil, and the dissected landscape, which is susceptible to gullying. A system of conservation tillage that leaves crop residue on the surface, contour farming, and terraces help to prevent excessive soil loss and gullying. Applications of fertilizer are needed, especially on the soils that formed in glacial material.

4. Nodaway-Colo-Tuskeego Association

Nearly level, moderately well drained and poorly drained, silty soils formed in alluvium on bottom land and stream terraces

This association consists of nearly level soils along the major rivers. The wider bottom land commonly has old stream channels and has meander scars near the present channels. Most areas are subject to flooding. Slopes range from 0 to 2 percent.

This association makes up about 9 percent of the county. It is about 20 percent Nodaway soils, 18 percent Colo soils, 16 percent Tuskeego soils, and 46 percent soils of minor extent.

Nodaway soils are moderately well drained and are on bottom land adjacent to the river channels. Colo soils are poorly drained and are on bottom land, on alluvial fans, and in old stream channels. Tuskeego soils are poorly drained and are on stream terraces.

Typically, the surface layer of the Nodaway soils is very dark grayish brown, friable silt loam about 8 inches thick. The substratum to a depth of about 60 inches is stratified very dark gray, dark grayish brown, and grayish brown silt loam.

Typically, the surface layer of the Colo soils is black, friable silty clay loam about 7 inches thick. The subsurface layer is silty clay loam about 40 inches thick. The upper part is black and friable, and the lower part is very dark gray and firm. The substratum to a depth of about 60 inches is dark gray silty clay loam that has strong brown mottles. In places the surface layer is stratified silt loam.

Typically, the surface layer of the Tuskeego soils is very dark gray, friable silt loam about 7 inches thick. The subsurface layer is gray and dark gray, friable silt loam and silty clay loam about 8 inches thick. The subsoil is about 39 inches thick. The upper part is dark gray, firm silty clay loam and silty clay. The next part is gray and grayish brown, firm silty clay and silty clay loam. The lower part of the subsoil and the substratum to a depth of about 60 inches are light brownish gray, friable silty clay loam mottled with strong brown.

The minor soils in this association are the Bremer, Lawson, and Watkins soils. Bremer soils have more clay in the surface layer than the major soils. They are on low stream terraces. The somewhat poorly drained Lawson soils are on bottom land adjacent to the river channels. They formed in dark, silty alluvium. Watkins soils have a brown subsoil. They are on stream terraces that normally are not flooded.

The soils in this association are used mainly for row crops. Some of the soils on bottom land are used for timber. Soybeans and corn are the major crops. The principal management concerns are flooding, drainage, and the variability of the soil material. Diversion terraces or levees can reduce the effects of flooding and remove excess water so that fieldwork can be more timely. Surface and subsurface drainage systems can remove excess water and thus improve the timeliness of fieldwork. In some of the nearly level areas on bottom land, however, locating suitable tile outlets is difficult. Because of the variability of the soil material, managing and maintaining fertility can be difficult.

5. Clinton-Lindley Association

Gently sloping to very steep, moderately well drained and well drained, silty and loamy soils formed in loess or glacial till on uplands

This association consists of soils that are highly dissected by drainageways and that in many areas border the bottom land along the major streams and rivers. Slopes range from 2 to 40 percent.

This association makes up about 28 percent of the county. It is about 46 percent Clinton soils, 20 percent Lindley soils, and 34 percent soils of minor extent (fig. 4).

Clinton soils are moderately well drained and are gently sloping to strongly sloping. They formed in loess on rounded ridgetops and the side slopes of interfluves. Typically, they are upslope from the other soils in the association. Lindley soils are well drained and are strongly sloping to very steep. They formed in glacial till. Typically, they are on the lower, steeper parts of side slopes on divides that are dissected by drainageways.

Typically, the surface layer of the Clinton soils is dark grayish brown and brown, friable silt loam about 8 inches thick. Because of plowing, it has some streaks and pockets of yellowish brown silty clay loam subsoil material. The subsoil to a depth of about 60 inches is yellowish brown silty clay loam. The upper part is firm, and the lower part is friable and has grayish brown mottles.

Typically, the surface layer of the Lindley soils is dark grayish brown, friable loam about 6 inches thick. Because of plowing, it has some streaks and pockets of strong brown clay loam subsoil material in some areas. The subsoil is firm clay loam about 40 inches thick. The upper part is strong brown, and the lower part is yellowish brown and strong brown. The substratum to a depth of about 60 inches is yellowish brown clay loam that has strong brown mottles. In places the surface layer is strong brown clay loam and contains less organic matter.

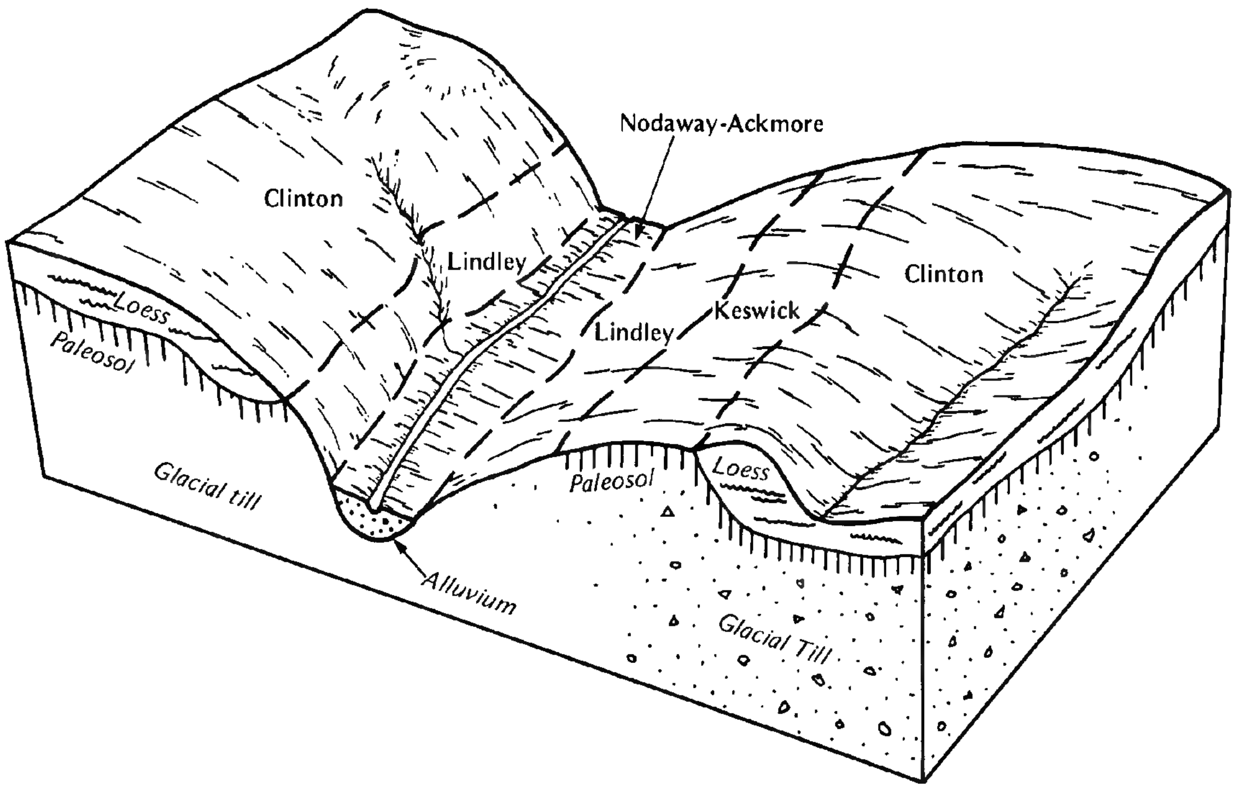


Figure 4.—Pattern of soils and parent material in the Clinton-Lindley association.

The minor soils in this association are the Ackmore, Chelsea, Fayette, Inton, Keswick, Lamont, and Nodaway soils. Ackmore and Nodaway soils formed in stratified, silty alluvium in upland drainageways. Chelsea soils are excessively drained. Chelsea and Lamont soils formed in eolian sand on upland side slopes adjacent to the major rivers and streams. Fayette and Inton soils formed in loess. Fayette soils have less clay in the subsoil than the Clinton soils. They are on the steeper side slopes. Inton soils have a gray, mottled subsoil. They are on convex and plane side slopes and at the head of drainageways below the Clinton soils. Keswick soils formed in a clayey paleosol on short, convex side slopes and nose slopes below the Clinton soils and above the Lindley soils.

The soils in this association are used for diversified farming. In many of the more gently sloping areas, corn is grown year after year or in a rotation with soybeans. In some of the more sloping areas, it is grown in rotation with meadow crops. The steeper areas are used for hay or pasture. They are better suited to hay, pasture, and timber than to row crops. Most areas of the association are not suited to intensive row cropping because of the slope and the erosion hazard. The principal management concerns are erosion, low fertility in the subsoil, and the highly dissected landscape, which is susceptible to gullying. A system of conservation tillage that leaves crop residue on the surface, contour farming, and terraces help to prevent excessive soil loss and gullying. Applications of fertilizer are needed, especially on the soils that formed in glacial material.

Detailed Soil Map Units

The map units on the detailed soil maps at the back of this survey represent the soils in the survey area. The map unit descriptions in this section, along with the soil maps, can be used to determine the suitability and potential of a soil for specific uses. They also can be used to plan the management needed for those uses. More information on each map unit, or soil, is given under "Use and Management of the Soils."

Each map unit on the detailed soil maps represents an area on the landscape and consists of one or more soils for which the unit is named.

A symbol identifying the soil precedes the map unit name in the soil descriptions. Each description includes general facts about the soil and gives the principal hazards and limitations to be considered in planning for specific uses.

Soils that have profiles that are almost alike make up a *soil series.* Except for differences in texture of the surface layer or of the substratum, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer or of the substratum. They also can differ in slope, stoniness, salinity, wetness, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases.* Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Nira silty clay loam, 5 to 9 percent slopes, moderately eroded, is one of several phases in the Nira series.

Some map units are made up of two or more major soils. These map units are called soil complexes. A *soil complex* consists of two or more soils, or one or more soils and a miscellaneous area, in such an intricate pattern or in such small areas that they cannot be shown separately on the soil maps. The pattern and proportion of the soils are somewhat similar in all areas. Gara-Armstrong complex, 9 to 14 percent slopes, moderately eroded, is an example.

Most map units include small scattered areas of soils other than those for which the map unit is named. Some of these included soils have properties that differ substantially from those of the major soil or soils. Such differences could significantly affect use and management of the soils in the map unit. The included soils are identified in each map unit description. Some small areas of strongly contrasting soils are identified by a special symbol on the soil maps.

This survey includes *miscellaneous areas.* Such areas have little or no soil material and support little or no vegetation. Pits, quarries, is an example. Miscellaneous areas are shown on the soil maps. Some that are too small to be shown are identified by a special symbol on the soil maps.

Table 4 gives the acreage and proportionate extent of each map unit. Other tables (see "Summary of Tables") give properties of the soils and the limitations, capabilities, and potentials for many uses. The Glossary defines many of the terms used in describing the soils.

Soil Descriptions

7B—Wiota silty clay loam, 1 to 5 percent slopes. This gently sloping, moderately well drained soil is on convex slopes on low stream terraces a few feet above the adjacent flood plains. This soil is subject to rare flooding. Areas are 3 to 12 acres in size and are irregularly shaped.

Typically, the surface layer is black, friable silty clay loam about 10 inches thick. The subsurface layer is very dark brown, friable silty clay loam about 9 inches thick. The subsoil is friable silty clay loam about 32 inches thick. The upper part is brown, the next part is yellowish brown and has a few grayish brown mottles, and the lower part is mottled yellowish brown, grayish brown, and strong brown. The substratum to a depth of about 60 inches is mottled yellowish brown and grayish brown silt loam. In places the soil has less clay in the subsoil and has a sandy substratum.

Included with this soil in mapping are small areas of the nearly level, somewhat poorly drained Nevin soils. These soils make up about 10 percent of the map unit.

Permeability is moderate in the Wiota soil, and runoff is medium. Available water capacity is high. The content of organic matter is about 3 to 4 percent in the surface layer. Reaction typically is slightly acid in the surface layer unless lime has been applied. The subsoil generally has a medium supply of available phosphorus and a low supply of available potassium.

Most areas are cultivated or are used for pasture®. Some are wooded. This soil is well suited to corn, soybeans, and small grain and to grasses and legumes

for hay and pasture. If cultivated crops are grown, erosion is a hazard. A system of conservation tillage that leaves crop residue on the surface helps to prevent excessive soil loss. Terracing and contour farming are impractical because areas of this soil are small and isolated and because the adjacent soils are nearly level. Good tilth generally can be easily maintained. Returning crop residue to the soil or regularly adding other organic material improves fertility, helps to prevent surface crusting, and increases the rate of water infiltration.

A cover of pasture plants or hay is effective in controlling erosion. Overgrazing or grazing when the soil is too wet, however, causes surface compaction and increases the likelihood of puddling. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and the soil in good condition.

The land capability classification is IIe.

11B—Colo-Ely silty clay loams, 2 to 5 percent slopes. These gently sloping soils are along narrow, intermittent drainageways in the uplands. The poorly drained Colo soil is on the lower parts of the landscape adjacent to the center of the drainageways. The somewhat poorly drained Ely soil is on foot slopes above the Colo soil. Both soils are subject to runoff from adjacent upland slopes. Areas range from 5 to more than 100 acres in size and are irregularly shaped. They are about 65 percent Colo soil and 35 percent Ely soil. The two soils occur as areas so intricately mixed or so small that mapping them separately is impractical.

Typically, the Colo soil has a surface layer of black, friable silty clay loam about 7 inches thick. The subsurface layer is silty clay loam about 40 inches thick. The upper part is black and friable, and the lower part is very dark gray and firm. The substratum to a depth of about 60 inches is dark gray silty clay loam that has a few brown mottles. In some places the surface layer is stratified silt loam. In other places the subsurface layer has more clay and is more slowly permeable.

Typically, the Ely soil has a surface layer of black and very dark brown, friable silty clay loam about 8 inches thick. The subsurface layer is black, very dark brown, and dark brown, friable silty clay loam about 18 inches thick. The subsoil to a depth of about 60 inches is friable silty clay loam. The upper part is mottled very dark grayish brown, dark grayish brown, and yellowish brown; the next part is mottled yellowish brown, brown, and grayish brown; and the lower part is mottled yellowish brown and grayish brown.

Permeability is moderate in both soils, and runoff is slow or medium. Available water capacity is high. Both soils have a seasonal high water table. The content of organic matter is 5 to 7 percent in the surface layer. Reaction generally is neutral to medium acid in the surface layer but varies because of local liming practices. The subsurface layer of the Colo soil generally has a medium supply of available phosphorus and a very low supply of available potassium. The subsurface layer of the Ely soil generally has a low supply of available phosphorus and potassium.

Most areas are cultivated or are used for hay and pasture. They are farmed along with the surrounding soils because they generally are too small, narrow, and irregularly shaped to be managed separately. These soils are suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. In most areas a drainage system is needed to reduce the wetness and provide good aeration and a deep root zone for plants. Tile drains are beneficial, especially in the Colo soil, if they are properly installed and if an adequate outlet is available. A system of conservation tillage that leaves crop residue on the surface helps to prevent excessive soil loss on the Ely soil.

Tilth generally is fair in the surface layer of the Colo soil and is good in the Ely soil. Returning crop residue to the soil or regularly adding other organic material and deferring tillage when the soils are wet help to maintain or improve tilth, improve fertility, prevent surface crusting, and increase the rate of water infiltration.

A cover of pasture plants or hay is effective in controlling excessive runoff and helps to prevent gullying. Overgrazing or grazing when the soils are too wet, however, causes surface compaction, increases the runoff rate, and results in poorer tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and the soils in good condition.

The land capability classification is IIw.

24D2—Shelby loam, 9 to 14 percent slopes, moderately eroded. This strongly sloping, well drained soil is on convex side slopes and ridgetops in the uplands. Areas are 5 to 15 acres in size and are irregularly shaped.

Typically, the surface layer is black, friable loam about 10 inches thick. Because of plowing, it has some streaks and pockets of dark yellowish brown clay loam subsoil material. The subsoil is clay loam about 45 inches thick. The upper part is dark yellowish brown and friable, the next part is yellowish brown and firm, and the lower part is mottled brown and yellowish brown and is firm. The substratum to a depth of about 60 inches is yellowish brown and light brownish gray, firm clay loam. In places the surface layer is clay loam and contains less organic matter because of severe erosion.

Included with this soil in mapping are some small areas of Adair soils. These soils occur as narrow bands on the upper part of the side slopes. They contain more clay in the subsoil than the Shelby soil and are seepy during wet periods. They make up less than 10 percent of the unit.

Permeability is moderately slow in the Shelby soil, and runoff is rapid. Available water capacity is high. The

content of organic matter is about 1 to 2 percent in the surface layer. Reaction typically is strongly acid in the surface soil and the upper part of the subsoil. The subsoil generally has a very low supply of available phosphorus and potassium.

Some areas are cultivated. Some large areas are used for pasture. In most areas this soil is managed along with the adjacent soils. It is moderately suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. If cultivated crops are grown, further erosion is a hazard. It can be controlled, however, by contour farming, terraces, a system of conservation tillage that leaves crop residue on the surface, and crop rotations that include meadow crops. Good tilth generally can be easily maintained. Returning crop residue to the soil or regularly adding other organic material and deferring tillage when the soil is wet help to maintain tilth, improve fertility, help to prevent surface crusting, and increase the rate of water infiltration.

A cover of pasture plants or hay is effective in controlling erosion. Overgrazing, however, causes surface compaction and poor tilth, increases the runoff rate, and reduces forage production. Proper stocking rates, pasture rotation, and timely deferment of grazing help to keep the pasture and the soil in good condition.

The land capability classification is IIIe.

41C—Sparta loamy fine sand, 2 to 9 percent slopes. This gently sloping and moderately sloping, excessively drained soil is on stream terraces several feet above the adjacent flood plains. It is commonly on dunelike ridges oriented from northwest to southeast. Areas are 3 to 10 acres in size and are irregularly shaped.

Typically, the surface layer is very dark grayish brown, very friable loamy fine sand about 8 inches thick. The subsurface layer is very dark grayish brown and dark brown, very friable loamy fine sand about 15 inches thick. The subsoil is yellowish brown, very friable fine sand about 15 inches thick. The substratum to a depth of about 60 inches is brownish yellow loose fine sand. It has strong brown bands between depths of 38 and 60 inches. In places the soil is steeper and typically has a thinner, lighter colored surface layer.

Included with this soil in mapping are areas of Wiota soils. These soils are in landscape positions similar to those of the Sparta soil. They are silty and have a higher available water capacity than the Sparta soil. They make up less than 10 percent of the unit.

Permeability is moderately rapid in the upper part of the Sparta soil and rapid in the lower part. Runoff is slow. Available water capacity is low. The content of organic matter is about 0.5 to 2.0 percent in the surface layer. Reaction varies widely in the surface layer as a result of local liming practices. The subsoil typically is strongly acid. It generally has a very low supply of available phosphorus and potassium. The surface layer is very friable but tends to crust after hard rains and puddle if tilled when wet.

Most areas are cropped along with larger areas of the adjacent soils that are well suited to crops. A few areas are used for pasture or hay. A very few areas are timbered. This soil generally is poorly suited to cultivated crops, but it is suited to small grain and to grasses and legumes for hay or pasture. Droughtiness is a severe limitation in most years unless rainfall is timely. If cultivated crops are grown, wind erosion is a severe hazard. Good tilth generally can be easily maintained.

A cover of pasture plants or hay is effective in controlling erosion. Overgrazing or grazing when the soil is too wet or too dry, however, reduces the extent of the protective plant cover and causes deterioration of the plant community. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet or dry periods help to keep the pasture and the soil in good condition.

This soil is moderately suited to trees. Seedling mortality is a severe limitation because of the droughtiness. As a result, seedlings should be planted at close intervals and should be watered often. Thinning the stand helps to provide adequate growing space for the surviving trees. Competing vegetation can be controlled by adequate site preparation or by spraying or cutting.

The land capability classification is IVs.

43—Bremer silty clay loam, 0 to 2 percent slopes. This nearly level, poorly drained soil is on low alluvial terraces on bottom land. It is subject to rare flooding. Areas range from 5 to 100 acres in size and are irregularly shaped.

Typically, the surface layer is black, friable silty clay loam about 10 inches thick. The subsurface layer is black, friable silty clay loam about 11 inches thick. The subsoil is about 36 inches thick. It is firm. The upper part is grayish brown silty clay, and the lower part is grayish brown and light brownish gray silty clay loam. The substratum to a depth of about 60 inches is light brownish gray, mottled silty clay loam.

Included with this soil in mapping are some small areas of Tuskeego soils. These soils are slightly lower on the landscape than the Bremer soil and have a thinner, lighter colored surface soil. Also, they contain more clay in the subsoil and are very slowly permeable. They make up less than 10 percent of the unit.

Permeability is moderately slow in the Bremer soil, and runoff is slow. Available water capacity is high. This soil has a seasonal high water table. The content of organic matter is about 5 to 7 percent in the surface layer. The shrink-swell potential is high. Reaction typically is slightly acid in the surface soil and the upper part of the subsoil. The subsoil generally has a medium supply of available phosphorus and a low supply of available potassium.

Most areas are cultivated. This soil is suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. A drainage system is needed to reduce the wetness and provide good aeration and a deep root zone for plants. Surface drains are needed in some areas. Tile drains work well if they are properly installed and if an adequate outlet is available. Tilth generally is fair. Returning crop residue to the soil or regularly adding other organic material and deferring tillage when the soil is wet improve tilth and fertility, help to prevent surface crusting, and increase the rate of water infiltration.

If this soil is used for pasture, overgrazing or grazing during wet periods causes surface compaction and poor tilth and reduces forage production.

The land capability classification is IIw.

54—Zook silty clay loam, 0 to 2 percent slopes. This nearly level, poorly drained soil is in the lower areas on bottom land. It is occasionally flooded. Areas range from 5 to more than 100 acres in size and are wide and irregularly shaped.

Typically, the surface layer is black, firm silty clay loam about 6 inches thick. The subsurface layer is about 35 inches thick. It is firm. The upper part is black silty clay, the next part is very dark gray silty clay, and the lower part is very dark gray silty clay loam. The subsoil is about 13 inches thick. It is gray, very firm silty clay that has strong brown mottles. The substratum to a depth of about 60 inches is gray, firm silty clay loam. In places the surface layer is overlain by about 12 inches of recently deposited, friable silt loam.

Permeability is slow. Runoff also is slow. Available water capacity is high. This soil has a seasonal high water table. The content of organic matter is about 5 to 7 percent in the surface layer. The shrink-swell potential is high. Reaction typically is neutral in the surface layer and subsurface layer. The subsoil generally has a medium supply of available phosphorus and a low supply of available potassium.

Most areas are cultivated. If adequately drained, this soil is moderately suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. A drainage system is needed to reduce the wetness and provide good aeration and a deep root zone for plants. Tile drains generally work satisfactorily only if they are closely spaced and if an adequate outlet is available. Surface drains are needed to remove surface water in some areas. Tilth generally is fair in the surface layer. It can be improved by returning crop residue to the soil and deferring tillage when the soil is wet.

If this soil is used for pasture, overgrazing or grazing during wet periods causes surface compaction and poor tilth.

The land capability classification is IIw.

58D2—Douds loam, 9 to 14 percent slopes, moderately eroded. This strongly sloping, moderately well drained soil is on side slopes on high upland benches that border the valleys of the major streams and their tributaries. Areas range from 5 to 20 acres in size and are irregularly shaped.

Typically, the surface layer is dark grayish brown, friable loam about 5 inches thick. Because of plowing, it has streaks and pockets of yellowish brown clay loam subsoil material. The subsoil extends to a depth of about 60 inches. The upper part is yellowish brown and brown, friable loam and clay loam; the next part is yellowish brown and strong brown, friable and firm clay loam; and the lower part is strong brown, mottled, friable, stratified clay loam, sandy clay loam, and sandy loam. In places the surface layer is thicker and darker and contains more organic matter.

Included with this soil in mapping are small areas of Nordness soils. These soils are on the lower part of the side slopes. They are shallow to limestone and are droughty. They make up about 2 to 3 percent of the unit.

Permeability is moderate in the Douds soil, and runoff is rapid. Available water capacity is moderate. This soil has a seasonal high water table. The content of organic matter is about 0.5 to 1.0 percent in the surface layer. The subsoil typically is strongly acid or medium acid. It generally has a very low supply of available phosphorus and potassium.

Most areas are cultivated or are used for pasture or hay. A few areas are wooded. This soil is poorly suited to corn and soybeans. It is well suited to grasses and legumes for hay and pasture. If cultivated crops are grown, erosion is a severe hazard. A system of conservation tillage that leaves crop residue on the surface and contour farming help to retain subsoil moisture and prevent excessive soil loss. The soil is generally not suitable for terracing. Tilth generally is fair.

A cover of pasture plants or hay is effective in controlling erosion. Proper stocking rates, pasture rotation, and timely deferment of grazing help to keep the pasture and the soil in good condition.

This soil is moderately well suited to trees. Laying out logging trails or roads on the contour helps to control erosion. Woodlots that are used for grazing are subject to compaction and erosion. Grazing also inhibits tree regeneration and causes root damage, which leads to heartrot and other diseases. Seedling mortality and plant competition are slight.

The land capability classification is IVe.

58E2—Douds loam, 14 to 18 percent slopes, moderately eroded. This moderately steep, moderately well drained soil is on side slopes on high upland benches that border the valleys of the major streams and their tributaries. Areas range from 5 to 20 acres in size and are irregularly shaped.

Typically, the surface layer is dark grayish brown, friable loam about 5 inches thick. Because of plowing, it has streaks and pockets of yellowish brown clay loam subsoil material. The subsoil extends to a depth of about 60 inches. The upper part is yellowish brown and brown, friable loam and clay loam; the next part is yellowish brown and strong brown, friable and firm clay loam; and the lower part is strong brown, mottled, friable, stratified clay loam, sandy clay loam, and sandy loam. In places the surface layer is thicker and darker and contains more organic matter.

Included with this soil in mapping are small areas of Nordness soils. These soils are on the lower part of the side slopes. They are shallow to limestone and are droughty. They make up about 2 to 3 percent of the unit.

Permeability is moderate in the Douds soil, and runoff is rapid. Available water capacity is moderate. This soil has a seasonal high water table. The content of organic matter is less than 0.5 percent in the surface layer. The subsoil typically is strongly acid or medium acid. It generally has a very low supply of available phosphorus and potassium.

Most areas are used for hay, pasture, or woodland. Because of the slope and a severe erosion hazard, this soil generally is unsuitable for cultivated crops. It is moderately suited to grasses and legumes for hay and pasture. Tilth generally is fair.

A cover of pasture plants or hay is effective in controlling erosion. Proper stocking rates, pasture rotation, and timely deferment of grazing help to keep the pasture and the soil in good condition.

This soil is moderately suited to trees. Erosion and the equipment limitation are the main management concerns. When new stands are established, cover crops help to control erosion. They should be carefully managed, however, so that the resulting plant competition is not excessive. Because of the moderately steep slope, operating some machinery is difficult or hazardous. Hand planting is needed in some areas. Woodlots that are used for grazing are subject to compaction and erosion. Grazing also inhibits tree regeneration and causes root damage, which leads to heartrot and other diseases.

The land capability classification is VIe.

65D—Lindley loam, 9 to 14 percent slopes. This strongly sloping, well drained soil is on convex nose slopes and side slopes in the uplands. Areas range from 5 to 50 acres in size and are irregularly shaped.

Typically, the surface layer is very dark grayish brown, friable loam about 4 inches thick. The subsurface layer is dark grayish brown, friable loam about 3 inches thick. The subsoil is firm clay loam about 44 inches thick. The upper part is strong brown, and the lower part is yellowish brown and strong brown. The substratum to a depth of about 60 inches is yellowish brown clay loam mottled with strong brown.

Included with this soil in mapping are small areas of Keswick soils. These soils occur as narrow bands on the upper part of the side slopes. They contain more clay in the subsoil than the Lindley soil and may be seepy during wet periods. They make up less than 10 percent of the unit.

Permeability is moderately slow in the Lindley soil, and runoff is rapid. Available water capacity is high. The content of organic matter is about 1.0 to 1.5 percent in the surface layer. Reaction typically is slightly acid in the surface layer and strongly acid in the subsoil. The subsoil generally has a low supply of available phosphorus and a very low supply of available potassium. In cultivated areas the surface layer tends to crust after hard rains and puddle if tilled when wet.

Most areas are used for trees or permanent pasture. A few areas are cultivated. This soil is poorly suited to corn and soybeans. If cultivated crops are grown, erosion is a severe hazard. A system of conservation tillage that leaves crop residue on the surface and grassed waterways help to prevent excessive soil loss. Growing the row crops in rotation with oats, hay, and pasture also is helpful. The soil is moderately suited to terracing. If exposed, the subsoil cannot be easily vegetated because it is dense and is low in fertility. Tilth generally is fair in the surface layer. Returning crop residue to the soil or regularly adding other organic material improves fertility, helps to prevent surface crusting, and increases the rate of water infiltration.

A cover of pasture plants or hay is effective in controlling erosion. Overgrazing or grazing when the soil is too wet, however, causes surface compaction and increases the runoff rate. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and the soil in good condition.

This soil is moderately well suited to trees. Laying out logging trails or roads on the contour or nearly on the contour helps to control erosion. Woodlots that are used for grazing are subject to compaction and erosion. Grazing also inhibits tree regeneration and causes root damage, which leads to heartrot and other diseases. Seedling mortality and plant competition are slight.

The land capability classification is IVe.

65D2—Lindley loam, 9 to 14 percent slopes, moderately eroded. This strongly sloping, well drained soil is on convex nose slopes and side slopes in the uplands. Areas range from 5 to 50 acres in size and are irregularly shaped.

Typically, the surface layer is dark grayish brown, friable loam about 6 inches thick. Because of plowing, it has streaks and pockets of strong brown clay loam subsoil material. The subsoil is firm clay loam about 43 inches thick. The upper part is strong brown, and the lower part is yellowish brown and strong brown. The substratum to a depth of about 60 inches is yellowish

brown clay loam mottled with strong brown. In places the surface layer is strong brown, firm clay loam and contains less organic matter because of severe erosion.

Included with this soil in mapping are small areas of Keswick soils. These soils occur as narrow bands on the upper part of the side slopes. They contain more clay in the subsoil than the Lindley soil and may be seepy during wet periods. They make up less than 10 percent of the unit.

Permeability is moderately slow in the Lindley soil, and runoff is rapid. Available water capacity is high. The content of organic matter is less than 0.5 percent in the surface layer. Reaction typically is slightly acid in the surface layer and strongly acid in the subsoil. The subsoil generally has a low supply of available phosphorus and a very low supply of available potassium. In cultivated areas the surface layer tends to crust after hard rains and puddle if tilled when wet.

Most areas are used for permanent pasture or cultivated crops. A few areas are wooded. This soil is poorly suited to corn and soybeans. If cultivated crops are grown, erosion is a severe hazard. A system of conservation tillage that leaves crop residue on the surface and grassed waterways help to prevent excessive soil loss. Growing the row crops in rotation with oats, hay, and pasture also is helpful. The soil is moderately suited to terracing. If exposed, the subsoil cannot be easily vegetated because it is dense and is low in fertility. Tilth generally is fair in the surface layer. Returning crop residue to the soil or regularly adding other organic material improves fertility, helps to prevent surface crusting, and increases the rate of water infiltration.

A cover of pasture plants or hay is effective in controlling erosion. Overgrazing or grazing when the soil is too wet, however, causes surface compaction and increases the runoff rate. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and the soil in good condition.

This soil is moderately well suited to trees. Laying out logging trails or roads on the contour or nearly on the contour helps to control erosion. Woodlots that are used for grazing are subject to compaction and erosion. Grazing also inhibits tree regeneration and causes root damage, which leads to heartrot and other diseases. Seedling mortality and plant competition are slight.

The land capability classification is IVe.

65E—Lindley loam, 14 to 18 percent slopes. This moderately steep, well drained soil is on nose slopes and side slopes in the uplands. Areas range from 5 to 100 acres in size and are irregularly shaped.

Typically, the surface layer is very dark grayish brown, friable loam about 4 inches thick. The subsurface layer is dark grayish brown, friable loam about 3 inches thick. The subsoil is firm clay loam about 40 inches thick. The upper part is strong brown, and the lower part is yellowish brown and strong brown. The substratum to a depth of about 60 inches is yellowish brown clay loam mottled with strong brown.

Included with this soil in mapping are small areas of Keswick soils. These soils occur as narrow bands on the upper part of the side slopes. They contain more clay in the subsoil than the Lindley soil and may be seepy during wet periods. They make up less than 10 percent of the unit.

Permeability is moderately slow in the Lindley soil, and runoff is rapid. Available water capacity is high. The content of organic matter is about 1.0 to 1.5 percent in the surface layer. This layer typically is slightly acid. The subsoil is strongly acid. It generally has a low supply of available phosphorus and a very low supply of available potassium.

Most areas are used for pasture and hay. A few areas support native hardwoods. Because of the slope and a severe hazard of erosion, this soil generally is unsuitable for cultivated crops. It is moderately suited to grasses and legumes for hay and pasture. Tilth generally is fair in the surface layer.

A cover of pasture plants or hay is effective in controlling erosion. Reseeding or pasture renovation is needed in some of the steeper areas. Preparing a seedbed, however, is difficult. Because of the slope, operating farm machinery is difficult and dangerous. Caution is needed when the machinery is operated. Overgrazing or grazing when the soil is too wet causes surface compaction and deterioration of tilth and increases the runoff rate. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and the soil in good condition.

This soil is moderately suited to trees. Erosion and the equipment limitation are the main management concerns. Carefully selecting sites for logging trails or roads and laying out the trails or roads on the contour help to control erosion. Because of the slope, special logging equipment is needed. Also, caution is needed when this equipment is operated. Because they do not survive well, seedlings should be planted at close intervals. Thinning the stand helps to provide adequate growing space for the surviving trees. Woodlots that are used for grazing are subject to compaction and erosion. Grazing also inhibits tree regeneration and causes root damage, which leads to heartrot and other diseases.

The land capability classification is VIe.

65E2—Lindley loam, 14 to 18 percent slopes, moderately eroded. This moderately steep, well drained soil is on convex nose slopes and side slopes in the uplands. Areas range from 5 to 100 acres in size and are irregularly shaped.

Typically, the surface layer is dark grayish brown, friable loam about 6 inches thick. Because of plowing, it

has some streaks and pockets of strong brown clay loam subsoil material. The subsoil is firm clay loam about 40 inches thick. The upper part is strong brown, and the lower part is yellowish brown and strong brown. The substratum to a depth of about 60 inches is yellowish brown clay loam mottled with strong brown. In places the surface layer is strong brown, firm clay loam because of severe erosion.

Included with this soil in mapping are small areas of Keswick soils. These soils occur as narrow bands on the upper part of the side slopes. They contain more clay in the subsoil than the Lindley soil and may be seepy during wet periods. They make up less than 10 percent of the unit.

Permeability is moderately slow in the Lindley soil, and runoff is rapid. Available water capacity is high. The content of organic matter is less than 0.5 percent in the surface layer. This layer typically is slightly acid. The subsoil is strongly acid. It generally has a low supply of available phosphorus and a very low supply of available potassium.

Most areas are used for pasture and hay but have been cultivated in the past. Some still are cultivated. A few areas support native hardwoods. Because of the slope and a severe hazard of erosion, this soil generally is unsuitable for cultivated crops. It is moderately suited to grasses and legumes for hay and pasture. Tilth generally is fair in the surface layer.

A cover of pasture plants or hay is effective in controlling erosion. Reseeding or pasture renovation is needed in some of the steeper areas. Preparing a seedbed, however, is difficult. Because of the slope, operating farm machinery is difficult and dangerous. Caution is needed when the machinery is operated. Overgrazing or grazing when the soil is too wet causes surface compaction and deterioration of tilth and increases the runoff rate. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and the soil in good condition.

This soil is moderately suited to trees. Erosion, the equipment limitation, and seedling mortality are the main management concerns. Carefully selecting sites for logging trails or roads and laying out the trails or roads on the contour help to control erosion. Because of the slope, special logging equipment is needed. Also, caution is needed when this equipment is operated. Because they do not survive well, seedlings should be planted at close intervals. Thinning the stand helps to provide adequate growing space for the surviving trees. Woodlots that are used for grazing are subject to compaction and erosion. Grazing also inhibits tree regeneration and causes root damage, which leads to heartrot and other diseases.

The land capability classification is VIe.

65F—Lindley loam, 18 to 25 percent slopes. This steep, well drained soil is on convex side slopes and nose slopes in the uplands. Areas range from 5 to 50 acres in size and are elongated.

Typically, the surface layer is very dark grayish brown, friable loam about 3 inches thick. The subsurface layer is dark grayish brown, friable loam about 3 inches thick. The subsoil is firm clay loam about 36 inches thick. The upper part is strong brown, and the lower part is yellowish brown and strong brown. The substratum to a depth of about 60 inches is yellowish brown clay loam mottled with strong brown.

Included with this soil in mapping are small areas of Keswick and Nordness soils. Keswick soils occur as narrow bands on the upper part of the side slopes. They contain more clay in the subsoil than the Lindley soil and may be seepy during wet periods. Nordness soils are on the lower part of the side slopes. They are shallow to limestone and are droughty. Included soils make up less than 10 percent of the unit.

Permeability is moderately slow in the Lindley soil, and runoff is rapid. Available water capacity is high. The content of organic matter is about 0.5 to 1.0 percent in the surface layer. This layer typically is slightly acid. The subsoil is strongly acid. It generally has a low supply of available phosphorus and a very low supply of available potassium.

Most areas are used for permanent pasture or are wooded. This soil is unsuitable for cultivated crops because erosion is a severe hazard and because most areas are too steep for the use of ordinary farm machinery. Tilth generally is fair in the surface layer.

A cover of pasture plants or hay is effective in controlling erosion. Overgrazing or grazing when the soil is too wet, however, causes surface compaction and increases the runoff rate. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and the soil in good condition.

This soil is moderately well suited to trees. Erosion and the equipment limitation are the main management concerns. Carefully selecting sites for logging trails or roads and laying out the trails or roads on the contour or nearly on the contour help to control erosion. Because of the slope, special logging equipment is needed. Also, caution is needed when this equipment is operated. Seedlings should be planted at close intervals because the survival rate is limited. Thinning the stand helps to provide adequate growing space for the surviving trees. Woodlots that are used for grazing are subject to compaction and erosion. Grazing also inhibits tree regeneration and causes root damage, which leads to heartrot and other diseases.

The land capability classification is VIIe.

65F2—Lindley loam, 18 to 25 percent slopes, moderately eroded. This steep, well drained soil is on

convex side slopes and nose slopes in the uplands. Areas range from 5 to 30 acres in size and are elongated.

Typically, the surface layer is dark grayish brown, friable loam about 6 inches thick. Because of plowing, it has some streaks and pockets of strong brown clay loam subsoil material. The subsoil is firm clay loam about 38 inches thick. The upper part is strong brown, and the lower part is yellowish brown and strong brown. The substratum to a depth of about 60 inches is yellowish brown clay loam mottled with strong brown. In some places the surface layer is strong brown, firm clay loam because of severe erosion.

Included with this soil in mapping are small areas of Keswick and Nordness soils. Keswick soils occur as narrow bands on the upper part of the side slopes. They contain more clay in the subsoil than the Lindley soil and may be seepy during wet periods. Nordness soils are shallow to limestone and are droughty. Included soils make up less than 10 percent of the unit.

Permeability is moderately slow in the Lindley soil, and runoff is rapid. Available water capacity is high. The content of organic matter is less than 0.5 percent in the surface layer. Unless limed, this layer typically is slightly acid. The subsoil typically is strongly acid. It generally has a low supply of available phosphorus and a very low supply of available potassium. In cultivated areas the surface layer tends to crust after hard rains and puddle if tilled when wet.

Although formerly cultivated, most areas are used for permanent pasture. A few areas are wooded. This soil is unsuitable for cultivated crops because further erosion is a severe hazard and because slopes are too steep for the use of ordinary farm machinery. Tilth generally is fair in the surface layer.

A cover of pasture plants or hay is effective in controlling erosion. Overgrazing or grazing when the soil is too wet, however, causes surface compaction and increases the runoff rate. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and the soil in good condition.

This soil is moderately well suited to trees. Seedling mortality, the equipment limitation, and the hazard of erosion are moderate. Carefully selecting sites for logging trails or roads and laying out the trails or roads on the contour or nearly on the contour help to control erosion. Because of the slope, special logging equipment is needed. Also, caution is needed when this equipment is operated. Seedlings should be planted at close intervals because the survival rate is limited. Thinning the stand helps to provide adequate growing space for the surviving trees. Woodlots that are used for grazing are subject to compaction and erosion. Grazing also inhibits tree regeneration and causes root damage, which leads to heartrot and other diseases.

The land capability classification is VIIe.

65G—Lindley loam, 25 to 40 percent slopes. This very steep, well drained soil is on dissected, convex side slopes along the major streams. Areas occur as long, narrow bands on the lower part of the side slopes. They range from 5 to 50 acres in size.

Typically, the surface layer is very dark grayish brown, friable loam about 2 inches thick. The subsurface layer is dark grayish brown, friable loam about 3 inches thick. The subsoil is firm clay loam about 28 inches thick. The upper part is strong brown, and the lower part is yellowish brown and strong brown. The substratum to a depth of about 60 inches is yellowish brown clay loam mottled with strong brown.

Included with this soil in mapping are small areas of Nordness soils. These soils are on the lower part of the side slopes. They are shallow to limestone and are droughty. Also included are areas where stones 1 to more than 3 feet in diameter are on the surface. These stones are generally in the drainageways at the base of slopes below the Lindley soil. They may affect use and management. Included areas make up less than 10 percent of the unit.

Permeability is moderately slow in the Lindley soil, and runoff is rapid. Available water capacity is high. The content of organic matter is about 0.5 to 1.0 percent in the surface layer. Reaction typically is slightly acid in the surface layer and strongly acid in the subsoil. The subsoil generally has a low supply of available phosphorus and a very low supply of available potassium.

Most areas are used as woodland. Many support native hardwoods. Because of the slope and a severe hazard of erosion, this soil generally is unsuitable for cultivated crops, hay, and pasture. It is moderately suited to trees. Erosion and the equipment limitation are the main management concerns in the wooded areas. Laying out logging trails or roads on the contour helps to control erosion. Because of the slope, operating some equipment is difficult or hazardous. Woodlots that are used for grazing are subject to compaction and erosion. Grazing also inhibits tree regeneration and causes root damage, which leads to heartrot and other diseases. Seedling mortality and plant competition generally are slight.

The land capability classification is VIIe.

74—Rubio silt loam, 0 to 2 percent slopes. This somewhat depressional and nearly level, poorly drained soil is on moderately wide, loess-covered upland divides. Areas range from 5 to 20 acres in size and are irregularly shaped.

Typically, the surface layer is very dark gray, friable silt loam about 8 inches thick. The subsurface layer is gray and dark gray, friable silt loam about 8 inches thick. The subsoil is about 38 inches thick. It is firm and is mottled with strong brown. The upper part is olive gray silty clay, and the lower part is light olive gray silty clay loam. The

substratum to a depth of about 60 inches is light olive gray silty clay loam mottled with strong brown. In some places the surface layer is thinner and lighter in color and contains less organic matter. In other places the soil is subject to ponding.

Included with this soil in mapping are small areas of the somewhat poorly drained Givin soils. These soils are on slightly convex or plane slopes. They make up about 5 to 10 percent of the unit.

Permeability is slow in the Rubio soil, and runoff is very slow. Available water capacity is high. This soil has a seasonal high water table. The content of organic matter is about 2.5 to 3.0 percent in the surface layer. The shrink-swell potential is high. The subsoil typically is strongly acid. It generally has a medium supply of available phosphorus and a very low supply of available potassium. The surface layer is friable and can be easily tilled under optimum moisture conditions. In the spring, however, it tends to warm up and dry slowly because of the poor drainage.

Most areas are cultivated. A few areas support native hardwoods. This soil is moderately suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. If cultivated crops are grown, a subsurface drainage system is needed to reduce the wetness and provide aeration and a deep root zone for plants. Except for some depressional areas, tile drains generally function satisfactorily if suitable outlets are available. In some areas a surface drainage system is needed. Tilth generally is fair. Returning crop residue to the soil and deferring fieldwork when the soil is wet help to prevent deterioration of tilth and improve fertility.

If this soil is used for pasture, overgrazing or grazing when the soil is wet causes surface compaction and poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and the soil in good condition.

This soil is poorly suited to trees because of the wetness. The main management concerns are the equipment limitation, the windthrow hazard, and seedling mortality. Logging equipment should be used only during the drier periods or during the winter, when the ground is frozen. Because they do not survive well, seedlings should be planted at close intervals. Thinning the stand helps to provide adequate growing space for the surviving trees. A drainage system that lowers the water table helps to prevent windthrow. Woodlots that are used for grazing are subject to compaction. Grazing also inhibits tree regeneration and causes root damage, which leads to heartrot and other diseases.

The land capability classification is IIIw.

75—Givin silt loam, 0 to 2 percent slopes. This nearly level, somewhat poorly drained soil is on the moderately wide tops of ridges in the uplands. Areas range from 5 to 50 acres in size and are irregularly shaped.

Typically, the surface layer is very dark gray, friable silt loam about 7 inches thick. The subsurface layer is grayish brown, friable silt loam about 6 inches thick. The subsoil extends to a depth of about 60 inches. It is mottled with yellowish brown. The upper part is brown and grayish brown, firm silty clay, the next part is grayish brown, firm silty clay loam, and the lower part is grayish brown, friable silty clay loam. In places the soil is more sloping and is subject to erosion.

Included with this soil in mapping are small areas of the poorly drained Rubio soils. These soils are in slightly depressional areas. They make up about 5 to 10 percent of the unit.

Permeability is moderately slow in the Givin soil, and runoff is slow. Available water capacity is high. This soil has a seasonal high water table. The content of organic matter is about 2 to 3 percent in the surface layer. The subsoil typically is medium acid or strongly acid. It generally has a medium supply of available phosphorus and a low supply of available potassium.

Most areas are cultivated. Some are used for hay and pasture. A few small areas support native hardwoods. This soil is well suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. Most areas are adequately drained. In some areas, however, tile drains are needed to improve the timeliness of fieldwork in wet years. They function satisfactorily if suitable outlets are available. If cultivated, some areas are subject to erosion. Good tilth generally can be easily maintained. Returning crop residue to the soil and delaying fieldwork when the soil is wet help to prevent deterioration of tilth and improve fertility.

A cover of pasture plants or hay is effective in controlling erosion. Overgrazing or grazing when the soil is wet, however, causes some surface compaction and deterioration of tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and the soil in good condition.

This soil is well suited to trees. Seedlings survive and grow well, and the hazards or limitations that affect planting and harvesting are slight. Woodlots that are used for grazing are subject to compaction and erosion. Grazing also inhibits tree regeneration and causes root damage, which leads to heartrot and other diseases.

The land capability classification is I.

76B—Ladoga silt loam, 2 to 5 percent slopes. This gently sloping, moderately well drained soil is on the tops and sides of ridges in the uplands. Areas range from 5 to 50 acres in size and are irregularly shaped.

Typically, the surface layer is very dark brown, friable silt loam about 8 inches thick. The subsoil is silty clay loam about 45 inches thick. The upper part is firm and is brown and yellowish brown. The lower part is friable, is

yellowish brown, and has grayish brown mottles. The substratum to a depth of about 60 inches is mottled yellowish brown and light brownish gray silty clay loam.

Included with this soil in mapping are areas of the nearly level, somewhat poorly drained Givin soils. These soils make up about 5 to 10 percent of the unit.

Permeability is moderately slow in the Ladoga soil, and runoff is medium. Available water capacity is high. The content of organic matter is about 2 to 3 percent in the surface layer. The subsoil typically is medium acid or strongly acid. It generally has a medium supply of available phosphorus and a low supply of available potassium.

Most areas are cultivated or are used for hay and pasture. A few areas support native hardwoods. This soil is well suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. If cultivated crops are grown, erosion is a hazard. A system of conservation tillage that leaves crop residue on the surface, contour farming, and terraces help to prevent excessive soil loss. In places, however, contour farming or terracing is difficult because of short, irregular slopes. Good tilth generally can be easily maintained. Returning crop residue to the soil or regularly adding other organic material improves fertility and helps to prevent deterioration of tilth.

A cover of pasture plants or hay is effective in controlling erosion. Proper stocking rates, pasture rotation, and timely deferment of grazing help to keep the pasture and the soil in good condition.

This soil is well suited to trees. Seedlings survive and grow well, and the hazards or limitations that affect planting and harvesting are slight. Woodlots that are used for grazing are subject to compaction and erosion. Grazing also inhibits tree regeneration and causes root damage, which leads to heartrot and other diseases.

The land capability classification is IIe.

76B2—Ladoga silt loam, 2 to 5 percent slopes, moderately eroded. This gently sloping, moderately well drained soil is on the tops and sides of convex ridges in the uplands. Areas range from 5 to 50 acres in size and are irregularly shaped.

Typically, the surface layer is very dark brown, friable silt loam about 8 inches thick. Because of plowing, it has some streaks and pockets of brown silty clay loam subsoil material. The subsoil is silty clay loam about 42 inches thick. The upper part is firm and is brown and dark yellowish brown. The lower part is friable, is yellowish brown, and has grayish brown mottles. The substratum to a depth of about 60 inches is yellowish brown and light brownish gray silty clay loam. In places the surface layer is mixed dark brown and brown silty clay loam and contains less organic matter because of severe erosion.

Included with this soil in mapping are areas of the nearly level, somewhat poorly drained Givin soils. These soils make up about 5 percent of the unit.

Permeability is moderately slow in the Ladoga soil, and runoff is medium. Available water capacity is high. The content of organic matter is about 1 to 2 percent in the surface layer. The subsoil typically is medium acid or strongly acid. It generally has a medium supply of available phosphorus and a low supply of available potassium.

Most areas are cultivated or are used for hay and pasture. A few areas support native hardwoods. This soil is well suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. If cultivated crops are grown, further erosion is a hazard. A system of conservation tillage that leaves crop residue on the surface, contour farming, and terraces help to prevent excessive soil loss. In places, however, contour farming or terracing is difficult because of short, irregular slopes. Good tilth generally can be easily maintained. Returning crop residue to the soil or regularly adding other organic material improves fertility and helps to prevent deterioration of tilth.

A cover of pasture plants or hay is effective in controlling erosion. Proper stocking rates, pasture rotation, and timely deferment of grazing help to keep the pasture and the soil in good condition.

This soil is well suited to trees. Seedlings survive and grow well, and the hazards or limitations that affect planting and harvesting are slight. Woodlots that are used for grazing are subject to compaction and erosion. Grazing also inhibits tree regeneration and causes root damage, which leads to heartrot and other diseases.

The land capability classification is IIe.

76C—Ladoga silt loam, 5 to 9 percent slopes. This moderately sloping, moderately well drained soil is on narrow ridgetops and side slopes in the uplands. Areas range from 5 to 40 acres in size and are irregularly shaped.

Typically, the surface layer is very dark grayish brown silt loam about 8 inches thick. The subsoil is silty clay loam about 42 inches thick. The upper part is firm and is brown and yellowish brown. The lower part is friable, is yellowish brown, and has grayish brown mottles. The substratum to a depth of about 60 inches is yellowish brown and light brownish gray silty clay loam. In places the subsoil is grayer and contains less clay.

Permeability is moderately slow, and runoff is medium. Available water capacity is high. The content of organic matter is about 1.5 to 2.5 percent in the surface layer. The subsoil typically is medium acid or strongly acid. It generally has a medium supply of available phosphorus and a low supply of available potassium.

Most areas are used for hay and pasture, and a few areas are cultivated. A few support native hardwoods. This soil is moderately suited to corn, soybeans, and

small grain and well suited to grasses and legumes for hay and pasture. If cultivated crops are grown, erosion is a hazard. A system of conservation tillage that leaves crop residue on the surface, contour farming, and terraces help to prevent excessive soil loss. In places, however, contour farming or terracing is difficult because of short, irregular slopes. Good tilth generally can be easily maintained. Returning crop residue to the soil or regularly adding other organic material improves fertility and helps to prevent deterioration of tilth.

A cover of pasture plants or hay is effective in controlling erosion. Pasture renovation is needed in many areas. Proper stocking rates, pasture rotation, and timely deferment of grazing help to keep the pasture and the soil in good condition.

This soil is well suited to trees. Seedlings survive and grow well, and the hazards or limitations that affect planting and harvesting are slight. Woodlots that are used for grazing are subject to compaction and erosion. Grazing also inhibits tree regeneration and causes root damage, which leads to heartrot and other diseases.

The land capability classification is IIIe.

76C2—Ladoga silt loam, 5 to 9 percent slopes, moderately eroded. This moderately sloping, moderately well drained soil is on narrow ridgetops and side slopes in the uplands. Areas range from 5 to 40 acres in size and are irregularly shaped.

Typically, the surface layer is very dark brown, friable silt loam about 8 inches thick. Because of plowing, it has some streaks and pockets of brown silty clay loam subsoil material. The subsoil is silty clay loam about 38 inches thick. The upper part is firm and is brown and yellowish brown. The lower part is friable, is yellowish brown, and has grayish brown mottles. The substratum to a depth of about 60 inches is yellowish brown and light brownish gray silty clay loam. In some places the subsoil is grayer and contains less clay. In other places the surface layer is mixed dark brown and brown silty clay loam and contains less organic matter because of severe erosion.

Permeability is moderately slow, and runoff is medium. Available water capacity is high. The content of organic matter is about 0.5 to 1.5 percent in the surface layer. The subsoil typically is medium acid or strongly acid. It generally has a medium supply of available phosphorus and a low supply of available potassium.

Most areas are cultivated. Some are used for hay and pasture. This soil is moderately suited to corn, soybeans, and small grain and well suited to grasses and legumes for hay and pasture. If cultivated crops are grown, further erosion is a hazard. A system of conservation tillage that leaves crop residue on the surface, contour farming, and terraces help to prevent excessive soil loss (fig. 5). In places, however, contour farming or terracing is difficult because of short, irregular slopes. Tilth generally is fair in the surface layer. Returning crop residue to the soil or regularly adding other organic material improves fertility and tilth.

A cover of pasture plants or hay is effective in controlling erosion. Pasture renovation is needed in some areas. Proper stocking rates, pasture rotation, and timely deferment of grazing during wet periods help to keep the pasture and the soil in good condition.

This soil is well suited to trees. Seedlings survive and grow well, and the hazards or limitations that affect planting and harvesting are slight. Woodlots that are used for grazing are subject to compaction and erosion. Grazing also inhibits tree regeneration and causes root damage, which leads to heartrot and other diseases.

The land capability classification is IIIe.

76C3—Ladoga silty clay loam, 5 to 9 percent slopes, severely eroded. This moderately sloping, moderately well drained soil is on narrow, convex ridgetops or convex side slopes and nose slopes in the loess-covered uplands. Areas range from 5 to 40 acres in size and are irregularly shaped.

Typically, the surface layer is dark brown and brown, firm silty clay loam about 7 inches thick. Streaks and pockets of very dark brown silt loam make up about 10 to 15 percent of this layer. The subsoil is silty clay loam about 30 inches thick. The upper part is firm and is brown and yellowish brown. The lower part is friable, is yellowish brown, and has grayish brown mottles. The substratum to a depth of about 60 inches is yellowish brown and light brownish gray silt loam. In places the subsoil is grayer and contains less clay.

Permeability is moderately slow, and runoff is rapid. Available water capacity is high. The content of organic matter is 0.5 to 1.0 percent in the surface layer. The subsoil typically is medium acid or strongly acid. It generally has a medium supply of available phosphorus and a low supply of available potassium.

Most areas are cultivated. Some are used for hay and pasture. This soil is poorly suited to corn, soybeans, and small grain and moderately suited to grasses and legumes for hay and pasture. If cultivated crops are grown, further erosion is a severe hazard. The surface layer tends to seal and crust when worked. As a result, the rate of water infiltration is reduced and the runoff rate is increased. The increased runoff rate accelerates sheet and gully erosion. A system of conservation tillage that leaves crop residue on the surface, contour farming, and terraces help to prevent excessive soil loss. In places, however, contour farming or terracing is difficult because of short, irregular slopes.

Tilth generally is poor in the surface layer. Surface crusting is a problem on this severely eroded soil. It has an adverse effect on seedling emergence. Returning crop residue to the soil or regularly adding other organic material improves fertility, helps to prevent surface crusting, and increases the rate of water infiltration. More nitrogen and more intensive management are needed on this soil than on less eroded Ladoga soils.

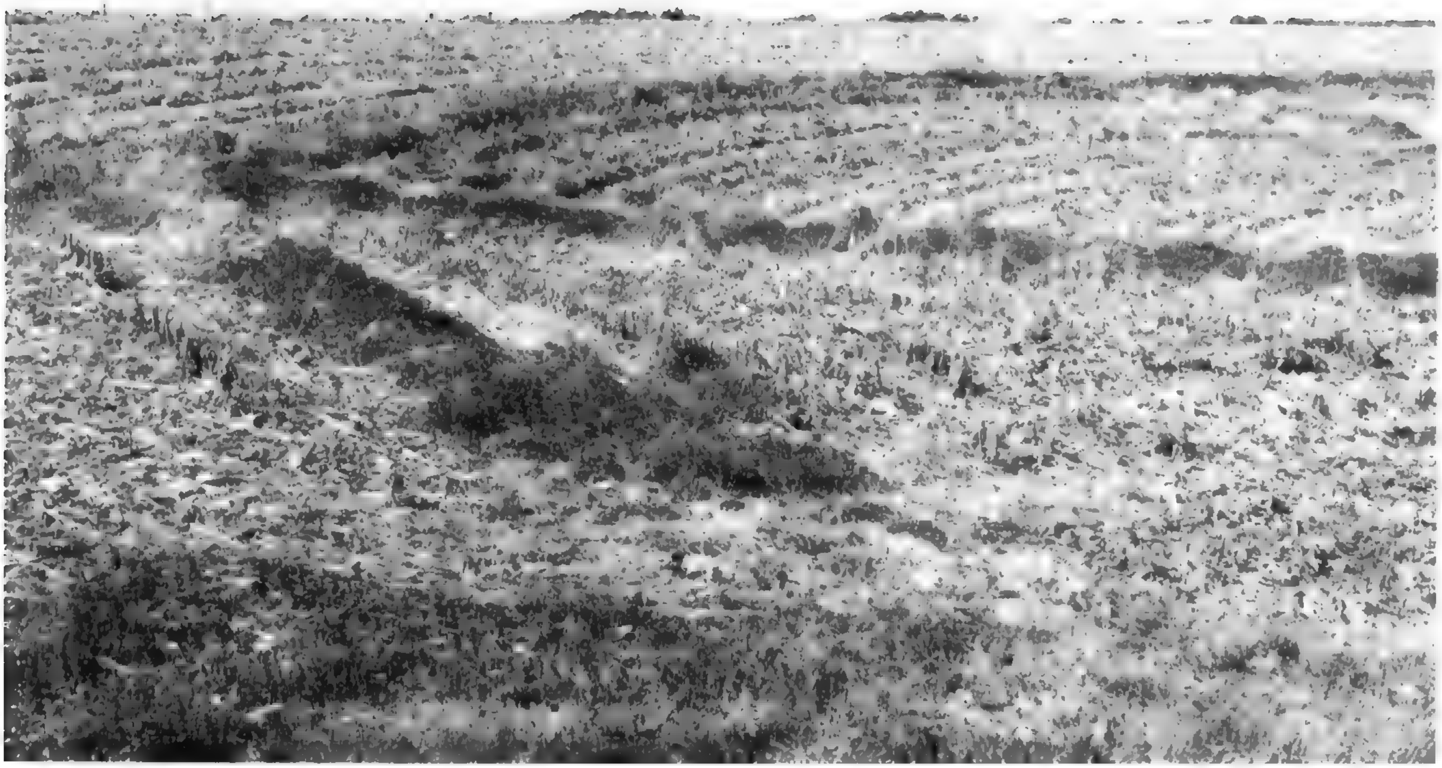


Figure 5.—An area of Ladoga silt loam, 5 to 9 percent slopes, moderately eroded, where a cover of crop residue helps to control further erosion.

A cover of pasture plants or hay is effective in controlling erosion. Pasture renovation is needed in some areas. Proper stocking rates, pasture rotation, and timely deferment of grazing during wet periods help to keep the pasture and the soil in good condition.

This soil is moderately well suited to trees. Seedlings do not survive and grow well. As a result, they should be planted at close intervals. Thinning the stand helps to provide adequate growing space for the surviving trees. Woodlots that are used for grazing are subject to compaction and erosion. Grazing also inhibits tree regeneration and causes root damage, which leads to heartrot and other diseases.

The land capability classification is IVe.

76D2—Ladoga silt loam, 9 to 14 percent slopes, moderately eroded. This strongly sloping, moderately well drained soil is on convex side slopes in the loess-covered uplands. Areas range from 5 to 40 acres in size and are irregularly shaped.

Typically, the surface layer is very dark brown, friable silt loam about 8 inches thick. Because of plowing, it has some streaks and pockets of brown silty clay loam subsoil material. The subsoil is silty clay loam about 36 inches thick. The upper part is firm and is brown and yellowish brown. The lower part is friable, is yellowish brown, and has a few grayish brown mottles. The substratum to a depth of about 60 inches is yellowish brown and light brownish gray silty clay loam. In some places the surface layer is brown silty clay loam and contains less organic matter because of severe erosion. In other places the subsoil is grayer and contains less clay.

Included with this soil in mapping are small areas of Armstrong soils. These soils are on the lower parts of the side slopes. They are redder and contain more clay in the subsoil than the Ladoga soil. They are seasonally wet and seepy. They make up about 5 percent of the unit.

Permeability is moderately slow in the Ladoga soil, and runoff is rapid. Available water capacity is high. The content of organic matter is about 0.5 to 1.0 percent in the surface layer. The subsoil typically is medium acid or strongly acid. It generally has a medium supply of available phosphorus and a low supply of available potassium.

Most areas are cultivated or are used for hay or pasture. A few areas support native hardwoods. This soil is moderately suited to corn, soybeans, and small grain and well suited to grasses and legumes for hay and pasture. If cultivated crops are grown, further erosion is a hazard. Row crops can be grown in some years if erosion is controlled. A system of conservation tillage that leaves crop residue on the surface helps to prevent excessive soil loss. Grassed waterways help to prevent gullying. In most areas contour farming and terracing are practical, but they are not so practical in undulating areas where slopes are short. Tilth generally is fair in the surface layer. Returning crop residue to the soil or regularly adding other organic material improves fertility and tilth and increases the rate of water infiltration.

A cover of pasture plants or hay is effective in controlling erosion. If permanent pastures are improved by renovating and reseeding, the content of organic matter in this moderately eroded soil slowly increases. Overgrazing or grazing when the soil is wet causes surface compaction and poor tilth and increases the runoff rate. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and the soil in good condition.

This soil is well suited to trees. No major hazards or limitations affect planting if the proper species are selected and the stand is managed properly. Woodlots that are used for grazing are subject to compaction and erosion. Grazing also inhibits tree regeneration and causes root damage, which leads to heartrot and other diseases.

The land capability classification is IIIe.

76D3—Ladoga silty clay loam, 9 to 14 percent slopes, severely eroded. This strongly sloping, moderately well drained soil is on convex side slopes in the loess-covered uplands. Areas range from 5 to 40 acres in size and are long and narrow.

Typically, the surface layer is dark brown and brown, firm silty clay loam about 7 inches thick. Streaks and pockets of very dark brown silt loam make up 10 to 15 percent of this layer. The subsoil is silty clay loam about 28 inches thick. The upper part is firm and is brown and dark yellowish brown. The lower part is friable, is yellowish brown, and has grayish brown mottles. The substratum to a depth of about 60 inches is yellowish brown and light brownish gray silt loam. In places the subsoil is grayer and contains less clay.

Included with this soil in mapping are small areas of Armstrong soils. These soils are on the lower parts of the side slopes. They are redder and contain more clay in the subsoil than the Ladoga soil. They are seasonally wet and seepy. They make up about 5 percent of the unit.

Permeability is moderately slow in the Ladoga soil, and runoff is rapid. Available water capacity is high. The content of organic matter is less than 0.5 percent in the surface layer. The subsoil typically is medium acid or strongly acid. It generally has a medium supply of available phosphorus and a low supply of available potassium.

Most areas are cultivated or are used for hay or pasture. This soil is poorly suited to corn, soybeans, and small grain and moderately suited to grasses and legumes for hay and pasture. If cultivated crops are grown, further erosion is a severe hazard. The surface layer tends to seal and crust when worked. As a result, the rate of water infiltration is reduced and the runoff rate is increased. The increased runoff rate accelerates sheet and gully erosion. Row crops can be grown in some years if erosion is controlled. A system of conservation tillage that leaves crop residue on the surface helps to prevent excessive soil loss. Grassed waterways help to prevent gullying. In most areas contour farming and terracing are practical, but they are not so practical in undulating areas where slopes are short.

Tilth generally is poor in the surface layer. Surface crusting is a problem on this severely eroded soil. It has an adverse effect on seedling emergence. Returning crop residue to the soil or regularly adding other organic material improves fertility, helps to prevent surface crusting, and increases the rate of water infiltration. More nitrogen and more intensive management are needed on this soil than on less eroded Ladoga soils.

A cover of pasture plants or hay is effective in controlling erosion. If permanent pastures are improved by renovating and reseeding, the content of organic matter in this severely eroded soil slowly increases. Overgrazing or grazing when the soil is wet causes surface compaction and poor tilth and increases the runoff rate. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and the soil in good condition.

This soil is moderately well suited to trees. Seedlings do not survive and grow well. As a result, they should be planted at close intervals. Thinning the stand helps to provide adequate growing space for the surviving trees. Woodlots that are used for grazing are subject to compaction and erosion. Grazing also inhibits tree regeneration and causes root damage, which leads to heartrot and other diseases.

The land capability classification is IVe.

80B—Clinton silt loam, 2 to 5 percent slopes. This gently sloping, moderately well drained soil is on ridgetops and side slopes in the loess-covered uplands. Areas range from 5 to more than 200 acres in size and are irregularly shaped.

Typically, the surface layer is very dark gray, friable silt loam about 3 inches thick. The subsurface layer is dark grayish brown, friable silt loam about 6 inches thick. The subsoil to a depth of about 60 inches is yellowish brown silty clay loam. The upper part is firm, and the lower part is friable and has grayish brown mottles. In places the surface layer is mixed with yellowish brown subsoil material and contains less organic matter.

Included with this soil in mapping are areas of the nearly level, somewhat poorly drained Keomah soils. These soils make up about 5 to 10 percent of the unit.

Permeability is moderately slow in the Clinton soil, and runoff is medium. Available water capacity is high. The content of organic matter is about 1.5 to 2.5 percent in the surface layer. The subsoil typically is strongly acid or medium acid. It generally has a high supply of available phosphorus and a low supply of available potassium.

Most areas are cultivated or are used for hay and pasture. A few areas support native hardwoods. This soil is well suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. If row crops are grown, erosion is a moderate hazard. A system of conservation tillage that leaves crop residue on the surface, contour farming, and terraces help to prevent excessive soil loss. In places, however, contour farming or terracing is difficult because of short, irregular slopes. Good tilth generally can be easily maintained. Returning crop residue to the soil or regularly adding other organic material improves fertility and helps to prevent deterioration of tilth.

A cover of pasture plants or hay is effective in controlling erosion. Proper stocking rates, pasture rotation, and timely deferment of grazing help to keep the pasture and the soil in good condition.

This soil is well suited to trees. Woodlots that are used for grazing are subject to compaction and erosion. Grazing also inhibits tree regeneration and causes root damage, which leads to heartrot and other diseases.

The land capability classification is IIe.

80C—Clinton silt loam, 5 to 9 percent slopes. This moderately sloping, moderately well drained soil is on the tops and sides of ridges in the loess-covered uplands. Areas range from 5 to 60 acres in size and are irregularly shaped.

Typically, the surface layer is very dark gray, friable silt loam about 3 inches thick. The subsurface layer is dark grayish brown, friable silt loam about 5 inches thick. The subsoil to a depth of about 60 inches is yellowish brown silty clay loam. The upper part is firm, and the lower part is friable and has grayish brown mottles. In some places the surface layer is mixed with yellowish brown subsoil material. In other places the subsoil is grayer and contains less clay.

Permeability is moderately slow, and runoff is medium. Available water capacity is high. The content of organic matter is about 1 to 2 percent in the surface layer. The subsoil typically is strongly acid or medium acid. It generally has a high supply of available phosphorus and a low supply of available potassium.

Most areas are used for pasture. Some are cultivated. A few small areas support native hardwoods. This soil is moderately suited to corn, soybeans, and small grain and well suited to grasses and legumes for hay and pasture. If cultivated crops are grown, erosion is a hazard. A system of conservation tillage that leaves crop residue on the surface, contour farming, and terraces help to prevent excessive soil loss. In places, however, contour farming or terracing is difficult because of short, irregular slopes. Good tilth generally can be easily maintained. Returning crop residue to the soil or regularly adding other organic material improves fertility and helps to prevent deterioration of tilth.

A cover of pasture plants or hay is effective in controlling erosion. Proper stocking rates, pasture rotation, and timely deferment of grazing help to keep the pasture and the soil in good condition.

This soil is well suited to trees. The hazards or limitations that affect planting and harvesting are slight. Woodlots that are used for grazing are subject to compaction and erosion. Grazing also inhibits tree regeneration and causes root damage, which leads to heartrot and other diseases.

The land capability classification is IIIe.

80C2—Clinton silt loam, 5 to 9 percent slopes, moderately eroded. This moderately sloping, moderately well drained soil is on the narrow tops and sides of ridges in the loess-covered uplands. Areas range from 5 to more than 100 acres in size and are irregularly shaped.

Typically, the surface layer is dark grayish brown and brown, friable silt loam about 8 inches thick. Because of plowing, it has some streaks and pockets of yellowish brown silty clay loam subsoil material. The subsoil to a depth of about 60 inches is yellowish brown silty clay loam. The upper part is firm, and the lower part is friable and has grayish brown mottles. In some places the surface layer is mixed brown and yellowish brown silty clay loam and contains less organic matter because of severe erosion. In other places the subsoil is grayer and contains less clay.

Permeability is moderately slow, and runoff is medium. Available water capacity is high. The content of organic matter is about 0.5 to 1.0 percent in the surface layer. The subsoil typically is strongly acid or medium acid. It generally has a high supply of available phosphorus and a low supply of available potassium.

Most areas are cultivated or are used for hay and pasture (fig. 6). A few areas support native hardwoods. This soil is moderately suited to corn, soybeans, and small grain and well suited to grasses and legumes for hay and pasture. If cultivated crops are grown, further erosion is a hazard. A system of conservation tillage that leaves crop residue on the surface, contour farming, and terraces help to prevent excessive soil loss. In places, however, contour farming or terracing is difficult because of short, irregular slopes. Tilth generally is fair in the surface layer. Returning crop residue to the soil or regularly adding other organic material improves fertility and tilth.

A cover of pasture plants or hay is effective in controlling erosion. Proper stocking rates, pasture rotation, and timely deferment of grazing help to keep the pasture and the soil in good condition.

This soil is well suited to trees. Woodlots that are used for grazing are subject to compaction and erosion. Grazing also inhibits tree regeneration and causes root damage, which leads to heartrot and other diseases.

The land capability classification is IIIe.

80C3—Clinton silty clay loam, 5 to 9 percent slopes, severely eroded. This moderately sloping, moderately well drained soil is on the narrow, convex tops and sides of ridges in the loess-covered uplands. Areas range from 5 to 80 acres in size and are irregularly shaped.

Typically, the surface layer is brown and yellowish brown, firm silty clay loam about 7 inches thick. Streaks and pockets of dark grayish brown silt loam make up 10 to 15 percent of this layer. The subsoil is yellowish brown silty clay loam about 38 inches thick. The upper part is firm, and the lower part is friable and has grayish brown mottles. The substratum to a depth of about 60 inches is mottled grayish brown and yellowish brown silt loam. In places the subsoil is grayer and contains less clay.

Permeability is moderately slow, and runoff is rapid. Available water capacity is high. The content of organic matter is less than 0.5 percent in the surface layer. The subsoil typically is strongly acid or medium acid. It generally has a high supply of available phosphorus and a low supply of available potassium.

Figure 6.—Hay in an area of Clinton silt loam, 5 to 9 percent slopes, moderately eroded.

Most areas are cultivated. Some are used for hay and pasture. This soil is poorly suited to corn, soybeans, and small grain and moderately suited to grasses and legumes for hay and pasture. If cultivated crops are grown, further erosion is a severe hazard. The surface layer tends to seal and crust when worked. As a result, the rate of water infiltration is reduced and the runoff rate is increased. The increased runoff rate accelerates sheet and gully erosion. A system of conservation tillage that leaves crop residue on the surface, contour farming, and terraces help to prevent excessive soil loss. In places, however, contour farming or terracing is difficult because of short, irregular slopes.

Tilth generally is poor in the surface layer. Surface crusting is a problem on this severely eroded soil. It has an adverse effect on seedling emergence. Returning crop residue to the soil or regularly adding other organic material improves fertility, helps to prevent surface crusting, and increases the rate of water infiltration. More nitrogen and more intensive management are needed on this soil than on less eroded Clinton soils.

A cover of pasture plants or hay is effective in controlling erosion. Proper stocking rates, pasture rotation, and timely deferment of grazing help to keep the pasture and the soil in good condition.

This soil is moderately well suited to trees. Seedlings do not survive and grow well. As a result, they should be planted at close intervals. Thinning the stand helps to provide adequate growing space for the surviving trees. Woodlots that are used for grazing are subject to compaction and erosion. Grazing also inhibits tree regeneration and causes root damage, which leads to heartrot and other diseases.

The land capability classification is IVe.

80D—Clinton silt loam, 9 to 14 percent slopes. This strongly sloping, moderately well drained soil is on convex side slopes in the loess-covered uplands. Areas range from 5 to 40 acres in size and are irregularly shaped.

Typically, the surface layer is very dark gray, friable silt loam about 3 inches thick. The subsurface layer is dark grayish brown, friable silt loam about 4 inches thick. The subsoil is yellowish brown silty clay loam about 50 inches thick. The upper part is firm, and the lower part is friable and has grayish brown mottles. The substratum to a depth of about 60 inches is mottled yellowish brown and grayish brown silt loam. In some places yellowish brown subsoil material is mixed into the surface layer. In other places the subsoil is grayer and contains less clay.

Included with this soil in mapping are areas of the poorly drained Ashgrove soils on the lower slopes near the head of drainageways. These soils have a subsoil of dense, gray clay. They make up about 5 percent of the unit.

Permeability is moderately slow in the Clinton soil, and runoff is rapid. Available water capacity is high. The content of organic matter is about 0.5 to 1.0 percent in the surface layer. The subsoil typically is strongly acid or medium acid. It generally has a high supply of available phosphorus and a low supply of available potassium.

Most areas are used for pasture (fig. 7). Some are cultivated. A few small areas support native hardwoods. This soil is moderately suited to corn, soybeans, and small grain and well suited to grasses and legumes for hay and pasture. If cultivated crops are grown, erosion is a severe hazard. A system of conservation tillage that leaves crop residue on the surface, contour farming, and terraces help to prevent excessive soil loss. In places, however, contour farming or terracing is difficult because of short, irregular slopes. Good tilth generally can be easily maintained. Returning crop residue to the soil or regularly adding other organic material improves fertility and helps to prevent deterioration of tilth.

A cover of pasture plants or hay is effective in controlling erosion. Pasture renovation is needed in many areas. Proper stocking rates, pasture rotation, and timely deferment of grazing help to keep the pasture and the soil in good condition.

This soil is well suited to trees. Woodlots that are used for grazing are subject to compaction and erosion. Grazing also inhibits tree regeneration and causes root damage, which leads to heartrot and other diseases.

The land capability classification is IIIe.

80D2—Clinton silt loam, 9 to 14 percent slopes, moderately eroded. This strongly sloping, moderately well drained soil is on the convex upper side slopes in the loess-covered uplands. Areas range from 5 to 40 acres in size and are irregularly shaped.

Typically, the surface layer is dark grayish brown and brown, friable silt loam about 8 inches thick. Because of plowing, it has some streaks and pockets of yellowish brown silty clay loam subsoil material. The subsoil is yellowish brown silty clay loam about 48 inches thick. The upper part is firm, and the lower part is friable and has grayish brown mottles. The substratum to a depth of about 60 inches is mottled yellowish brown and grayish brown silt loam. In some places the surface layer is mixed brown and yellowish brown silty clay loam and contains less organic matter because of severe erosion. In other places the subsoil is grayer and contains less clay.

Included with this soil in mapping are small areas of the poorly drained Ashgrove soils on the lower slopes near the head of small drainageways. These soils have a subsoil of dense, gray clay. They make up about 5 percent of the unit.

Permeability is moderately slow in the Clinton soil, and runoff is rapid. Available water capacity is high. The content of organic matter is less than 0.5 percent in the surface layer. The subsoil typically is strongly acid or medium acid. It generally has a high supply of available phosphorus and a low supply of available potassium.

Figure 7.—A pond in a partly wooded area of Clinton silt loam, 9 to 14 percent slopes, used for pasture.

Many areas are cultivated. Some are used for hay and pasture. Very few areas support native hardwoods. Nearly all areas were cultivated in the past. This soil is moderately suited to corn, soybeans, and small grain and well suited to grasses and legumes for hay and pasture. If cultivated crops are grown, further erosion is a severe hazard. A system of conservation tillage that leaves crop residue on the surface, terraces, and contour farming help to prevent excessive soil loss. In places, however, contour farming or terracing is difficult because of short, irregular slopes. Tilth generally is fair in the surface layer. Returning crop residue to the soil or regularly adding other organic material improves fertility and tilth.

A cover of pasture plants or hay is effective in controlling erosion. Proper stocking rates, pasture rotation, and timely deferment of grazing help to keep the pasture and the soil in good condition.

This soil is well suited to trees. Woodlots that are used for grazing are subject to compaction and erosion. Grazing also inhibits tree regeneration and causes root damage, which leads to heartrot and other diseases.

The land capability classification is IIIe.

80D3—Clinton silty clay loam, 9 to 14 percent slopes, severely eroded. This strongly sloping, moderately well drained soil is on convex side slopes in the loess-covered uplands. Areas range from 5 to 40 acres in size and are irregularly shaped.

Typically, the surface layer is brown and yellowish brown, firm silty clay loam about 7 inches thick. Streaks and pockets of dark grayish brown silt loam make up 10

to 15 percent of this layer. The subsoil is yellowish brown silty clay loam about 34 inches thick. The upper part is firm, and the lower part is friable and has grayish brown mottles. The substratum to a depth of about 60 inches is mottled grayish brown and yellowish brown silt loam. In places the subsoil is grayer and contains less clay.

Included with this soil in mapping are small areas of the poorly drained Ashgrove soils on the lower slopes near the head of small drainageways. These soils have a subsoil of dense, gray clay. They make up about 10 percent of the unit.

Permeability is moderately slow in the Clinton soil, and runoff is rapid. Available water capacity is high. The content of organic matter is less than 0.5 percent in the surface layer. The subsoil typically is strongly acid or medium acid. It generally has a high supply of available phosphorus and a low supply of available potassium.

Most areas are cultivated. Some are used for hay and pasture. Nearly all were cultivated in the past. This soil is poorly suited to corn, soybeans, and small grain and moderately suited to grasses and legumes for hay and pasture. If cultivated crops are grown, further erosion is a severe hazard. The surface layer tends to seal and crust when worked. As a result, the rate of water infiltration is reduced and the runoff rate is increased. The increased runoff rate accelerates sheet and gully erosion. A system of conservation tillage that leaves crop residue on the surface, terraces, and contour farming help to prevent excessive soil loss. In places, however, contour farming or terracing is difficult because of short, irregular slopes.

Tilth generally is poor in the surface layer. Surface crusting is a problem on this severely eroded soil. It has an adverse effect on seedling emergence. Returning crop residue to the soil or regularly adding other organic material improves fertility, helps to prevent surface crusting, and increases the rate of water infiltration. More nitrogen and more intensive management are needed on this soil than on less eroded Clinton soils.

A cover of pasture plants or hay is effective in controlling erosion. Proper stocking rates, pasture rotation, and timely deferment of grazing help to keep the pasture and the soil in good condition.

This soil is moderately well suited to trees. Seedlings do not survive and grow well. As a result, they should be planted at close intervals. Thinning the stand helps to provide adequate growing space for the surviving trees. Woodlots that are used for grazing are subject to compaction and erosion. Grazing also inhibits tree regeneration and causes root damage, which leads to heartrot and other diseases.

The land capability classification is IVe.

87B—Colo-Zook silty clay loams, 0 to 3 percent slopes. These nearly level and very gently sloping, poorly drained soils are along narrow, intermittent drainageways in the uplands. The Colo soil is adjacent to the center of the drainageways, and the Zook soil is in slightly concave areas adjacent to foot slopes. The soils are subject to runoff from adjacent upland slopes. Areas range from 5 to more than 100 acres in size. They are about 60 percent Colo soil and 25 percent Zook soil. The two soils occur as areas so intricately mixed or so small that mapping them separately is impractical.

Typically, the surface layer of the Colo soil is black, friable silty clay loam about 7 inches thick. The subsurface layer is silty clay loam about 40 inches thick. The upper part is black and friable, and the lower part is very dark gray and firm. The substratum to a depth of about 60 inches is dark gray silty clay loam mottled with brown. In some places the soil has a stratified silt loam surface layer. In other places the stratified material is 20 to 36 inches thick.

Typically, the surface layer of the Zook soil is black, firm silty clay loam about 6 inches thick. The subsurface layer is about 35 inches thick. It is firm. The upper part is black silty clay, the next part is very dark gray silty clay, and the lower part is very dark gray silty clay loam. The subsoil is about 13 inches thick. It is gray, very firm silty clay mottled with strong brown. The substratum to a depth of about 60 inches is gray silty clay loam. In places the surface layer is overlain by about 12 inches of recently deposited silt loam.

Included with these soils in mapping are small areas of Ely soils. These included soils have brown mottles. They contain less clay than the Zook and Colo soils and are better drained. They are on foot slopes above the Colo and Zook soils. They make up about 15 percent of the unit.

Permeability is moderate in the Colo soil and slow in the Zook soil. Runoff is slow or medium on both soils. Available water capacity is high. Both soils have a seasonal high water table. The content of organic matter is about 5 to 7 percent in the surface layer. The shrink-swell potential is high. Reaction typically is neutral in the subsurface layer of both soils. The subsurface layer of the Colo soil generally has a medium supply of available phosphorus and a very low supply of available potassium. The subsurface layer of the Zook soil generally has a medium supply of available phosphorus and a low supply of available potassium.

Most areas are cultivated. If drained, these soils are well suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. Most areas are farmed along with the surrounding soils because they are generally too small, narrow, and irregular in shape to be managed separately. In most areas a drainage system is needed to reduce the wetness and provide good aeration and a deep root zone for plants. Drainage ditches improve subsurface drainage and channel excess water away from these areas. Tile drains are beneficial, especially in the Colo soil. Because of the slow permeability, properly placing the tile drains is more important in the Zook soil than in the Colo soil. Also,

improving subsurface drainage is more difficult. Installing interceptor tile in the adjacent upland areas helps to control seepage.

Tilth generally is fair in the surface layer of these soils. Returning crop residue to the soils, regularly adding other organic material, and deferring tillage when the soils are wet improve tilth and fertility, help to prevent surface crusting, and increase the rate or water infiltration.

A cover of pasture plants or hay is effective in controlling erosion. Overgrazing or grazing when these soils are wet causes surface compaction, increases the runoff rate, and results in poorer tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and the soil in good condition.

The land capability classification is IIw.

88—Nevin silty clay loam, 0 to 2 percent slopes. This nearly level, somewhat poorly drained soil is on stream terraces. It is subject to rare flooding. Areas range from 5 to 80 acres in size and are irregularly shaped.

Typically, the surface layer is black, friable silty clay loam about 8 inches thick. The subsurface layer is about 12 inches thick. It is black, friable silty clay loam mottled with grayish brown. The subsoil to a depth of about 60 inches is friable silty clay loam. The upper part is mottled grayish brown and brown, and the lower part is grayish brown and is mottled with strong brown.

Included with this soil in mapping are small areas of Bremer soils. These soils are on the more nearly level parts of the landscape and are poorly drained. They contain more clay in the subsoil than the Nevin soil. They make up about 3 to 5 percent of the unit.

Permeability is moderate in the Nevin soil, and runoff is slow. Available water capacity is high. This soil has a seasonal high water table. The content of organic matter is about 4 to 6 percent in the surface layer. Reaction typically is neutral in the surface layer and medium acid in the upper part of the subsoil. The subsoil generally has a medium supply of available phosphorus and a low supply of available potassium.

Most areas are cultivated. This soil is well suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. Tile drains generally are not needed but are beneficial in some areas. Good tilth generally can be easily maintained. Returning crop residue to the soil or regularly adding other organic material and deferring tillage when the soil is wet help to maintain tilth, improve fertility, help to prevent surface crusting, and increase the rate of water infiltration.

If this soil is used for pasture, overgrazing or grazing during wet periods causes surface compaction and poor tilth and reduces forage production.

The land capability classification is I.

93D2—Shelby-Adair complex, 9 to 14 percent slopes, moderately eroded. These strongly sloping soils are on upland side slopes. The well drained Shelby soil is on the lower part of the slopes, and the somewhat poorly drained Adair soil is on the upper part. Areas range from 5 to 80 acres in size and are irregularly shaped. They are about 55 percent Shelby soil and 35 percent Adair soil. The two soils occur as areas so intricately mixed or so small that mapping them separately is impractical.

Typically, the surface layer of the Shelby soil is black, friable loam about 10 inches thick. Because of plowing, it has some streaks and pockets of dark yellowish brown clay loam subsoil material. The subsoil is clay loam about 45 inches thick. The upper part is dark yellowish brown and friable, the next part is yellowish brown and firm, and the lower part is mottled brown and yellowish brown and is firm. The substratum to a depth of about 60 inches is yellowish brown and light brownish gray, firm clay loam. In places the surface layer is clay loam and contains less organic matter because of severe erosion.

Typically, the surface layer of the Adair soil is very dark grayish brown, friable silty clay loam about 10 inches thick. Because of plowing, it has some streaks and pockets of brown silty clay subsoil material. The subsoil is about 44 inches thick. The upper part is mottled brown, grayish brown, and red, very firm silty clay and clay, and the lower part is light brownish gray, firm clay loam mottled with strong brown. The substratum to a depth of about 60 inches is yellowish brown clay loam mottled with light brownish gray. In places the surface layer is clay loam and contains less organic matter because of severe erosion.

Included with these soils in mapping are small areas of Otley soils. These included soils are silty throughout. They are higher on the landscape than the Shelby and Adair soils. They make up less than 10 percent of the unit.

Permeability is moderately slow or slow in the Shelby and Adair soils, and runoff is rapid. Available water capacity is high. The Adair soil has a seasonal high water table. The content of organic matter is 1.0 to 2.5 percent in the surface layer of both soils. The shrink-swell potential is high in the Adair soil. The subsoil of the Shelby soil typically is medium acid and strongly acid, and that of the Adair soil is neutral to medium acid. The subsoil of both soils generally has a very low supply of available phosphorus and potassium.

Most areas are cultivated. Some large areas are used for hay and pasture. Most areas are managed along with the adjacent soils. They are poorly suited to corn, soybeans, and small grain. They are moderately suited to grasses and legumes for hay and pasture. If cultivated crops are grown, further erosion is a hazard. It can be controlled, however, by contour farming, terraces, a system of conservation tillage that leaves crop residue

on the surface, and crop rotations that include meadow crops. Terrace cuts should be shallow enough to prevent exposure of the clayey subsoil.

Good tilth generally can be easily maintained in the Shelby soil. Tilth generally is fair in the Adair soil. Returning crop residue to the soil or regularly adding other organic material helps to maintain good tilth and fertility, helps to prevent surface crusting, and increases the rate of water infiltration. Because these soils are seepy when wet, measures that help to prevent compaction of the surface layer are needed. Also, the soils should not be worked during wet periods.

A cover of pasture plants or hay is effective in controlling erosion. Overgrazing, however, causes surface compaction and poor tilth, increases the runoff rate, and reduces forage production. Proper stocking rates, pasture rotation, and timely deferment of grazing, especially during wet periods, help to keep the pasture and the soils in good condition.

The land capability classification is IVe.

93D3—Shelby-Adair clay loams, 9 to 14 percent slopes, severely eroded. These strongly sloping soils are on upland side slopes. The well drained Shelby soil is on the lower part of the slopes, and the somewhat poorly drained Adair soil is on the upper part. Areas range from 5 to 80 acres in size and are irregularly shaped. They are about 55 percent Shelby soil and 35 percent Adair soil. The two soils occur as areas so intricately mixed or so small that mapping them separately is impractical.

Typically, the Shelby soil has a surface layer of dark yellowish brown, firm clay loam about 7 inches thick. Streaks and pockets of black loam make up about 10 to 15 percent of this layer. The subsoil is firm clay loam about 35 inches thick. The upper part is dark yellowish brown, and the lower part is mottled brown and yellowish brown. The substratum to a depth of about 60 inches is yellowish brown and light brownish gray, firm clay loam. In places the surface layer is calcareous.

Typically, the Adair soil has a surface layer of brown and reddish brown, firm clay loam about 7 inches thick. Streaks and pockets of very dark grayish brown silty clay loam make up 10 to 15 percent of this layer. The subsoil is about 35 inches thick. The upper part is mottled brown, grayish brown, and red, very firm silty clay and clay, and lower part is light brownish gray, firm clay loam mottled with strong brown. The substratum to a depth of about 60 inches is yellowish brown clay loam mottled with light brownish gray.

Included with these soils in mapping are small areas of Otley soils. These included soils are silty throughout. They are higher on the landscape than the Shelby and Adair soils. They make up less than 10 percent of the unit.

Permeability is moderately slow or slow in the Shelby and Adair soils, and runoff is rapid. Available water capacity is high. The Adair soil has a seasonal high water table. The content of organic matter is about 0.5 to 1.0 percent in the surface layer of both soils. The shrink-swell potential is high in the Adair soil. The subsoil of the Shelby soil typically is medium acid and strongly acid, and that of the Adair soil is neutral to medium acid. The subsoil of both soils generally has a very low supply of available phosphorus and potassium.

Some areas are cultivated. Almost all areas have been cultivated in the past. Many areas are now used for hay and pasture. In most areas these soils are managed along with the adjacent soils. Because of the slope and a severe hazard of erosion, they are generally unsuited to corn, soybeans, and small grain. They are poorly suited to grasses and legumes for hay and pasture. The surface layer tends to seal and crust when worked. As a result, the rate of water infiltration is reduced and the runoff rate is increased. The increased runoff accelerates sheet and gully erosion.

A cover of pasture plants or hay is effective in controlling erosion. Overgrazing, however, causes surface compaction and poor tilth, increases the runoff rate, and reduces forage production. Proper stocking rates, pasture rotation, and timely deferment of grazing help to keep the pasture and the soils in good condition.

The land capability classification is VIe.

122—Sperry silt loam, 0 to 2 percent slopes. This nearly level, very poorly drained soil is in slight depressions on broad upland divides. It is subject to ponding. Areas are 2 to more than 4 acres in size and are irregularly shaped.

Typically, the surface layer is very dark gray, friable silt loam about 9 inches thick. The subsoil is about 46 inches thick. In sequence downward, it is dark gray and very dark gray, friable silty clay loam; mottled very dark gray and dark gray, firm silty clay and silty clay loam; grayish brown, firm silty clay and silty clay loam mottled with strong brown; and light brownish gray and grayish brown, friable silty clay loam mottled with strong brown. The substratum to a depth of about 60 inches is light brownish gray and grayish brown silty clay loam mottled with strong brown.

Included with this soil in mapping are small areas of Taintor soils. These soils are on the higher parts of the landscape between the depressional areas of the Sperry soil. They are better drained than the Sperry soil and contain less clay in the subsoil. They make up about 10 percent of the unit.

Permeability is slow in the Sperry soil, and runoff is very slow or ponded. Available water capacity is high. This soil has a seasonal high water table. The content of organic matter is about 3 to 4 percent in the surface layer. The shrink-swell potential is high. The subsoil typically is neutral or slightly acid. It generally has a low supply of available phosphorus and a very low supply of available potassium.

Most areas are cultivated. This soil is moderately suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. If cultivated crops are grown, a subsurface drainage system is needed to reduce the wetness and provide aeration and a deep root zone for plants. Tile drains generally do not function satisfactorily because the soil is slowly permeable. In most areas a surface drainage system is needed. Tilth generally is poor in the surface layer. The soil can be easily tilled, however, under optimum moisture conditions. In the spring it tends to warm up and dry slowly because of the very poor drainage. Returning crop residue to the soil and deferring fieldwork when the soil is wet improve fertility and help to prevent deterioration of tilth.

A cover of pasture plants or hay is effective in controlling erosion. Overgrazing or grazing when the soil is wet, however, causes surface compaction and deterioration of tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and the soil in good condition.

The land capability classification is IIIw.

133—Colo silty clay loam, 0 to 2 percent slopes. This nearly level, poorly drained soil is on bottom land. It is occasionally flooded unless it is protected. Areas range from 5 to more than 150 acres in size and are irregularly shaped.

Typically, the surface layer is black, friable silty clay loam about 7 inches thick. The subsurface layer is silty clay loam about 40 inches thick. The upper part is black and friable, and the lower part is very dark gray and firm. The substratum to a depth of about 60 inches is dark gray silty clay loam mottled with strong brown. In some places about 12 inches of recently deposited silt loam overlies the surface layer. In other places the surface soil is stratified silt loam 20 to 36 inches thick.

Permeability is moderate in the Colo soil, and runoff is slow. Available water capacity is high. This soil has a seasonal high water table. The shrink-swell potential is high. The content of organic matter is about 5 to 7 percent in the surface layer. The soil typically is neutral or slightly acid throughout. The substratum generally has a medium supply of available phosphorus and a very low supply of available potassium.

Most areas are cultivated. Especially if protected from flooding, this soil is well suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. A drainage system is needed to reduce the wetness and provide good aeration and a deep root zone for plants. Tile drains work well if they are properly installed and if an adequate outlet is available. Tilth generally is fair in the surface layer. Returning crop residue to the soil or regularly adding other organic material and deferring tillage when the soil is wet improve tilth and fertility, help to prevent surface crusting, and increase the rate of water infiltration.

If this soil is used for pasture, overgrazing or grazing during wet periods causes surface compaction and poor tilth and reduces forage production. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use, especially during wet periods, help to keep the pasture and the soil in good condition.

The land capability classification is IIw.

133+—Colo silt loam, overwash, 0 to 2 percent slopes. This nearly level, poorly drained soil is on the lower parts of bottom land. It is occasionally flooded unless it is protected. Areas range from 5 to more than 100 acres in size and are irregularly shaped.

Typically, the surface layer is stratified very dark brown, very dark gray, and grayish brown, friable silt loam about 12 inches thick. Below this is a black and very dark gray buried soil, which is friable and firm silty clay loam about 40 inches thick. The substratum to a depth of about 60 inches is dark gray silty clay loam. In places the black and very dark gray buried soil is firm silty clay and is more slowly permeable.

Permeability is moderate in the Colo soil, and runoff is slow. Available water capacity is high. This soil has a seasonal high water table. The content of organic matter is about 3 to 5 percent in the surface layer. The shrink-swell potential is high. The soil typically is neutral or slightly acid throughout. The substratum generally has a medium supply of available phosphorus and a very low supply of available potassium.

Most areas are cultivated. This soil is suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. A drainage system is needed to reduce the wetness and provide good aeration and a deep root zone for plants. Tile drains work well if they are properly installed and if an adequate outlet is available. Good tilth generally can be easily maintained. Returning crop residue to the soil or regularly adding other organic material and deferring tillage when the soil is wet help to maintain tilth, improve fertility, help to prevent surface crusting, and increase the rate of water infiltration.

If this soil is used for pasture, overgrazing or grazing during wet periods causes surface compaction and poor tilth and reduces forage production. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use, especially during wet periods, help to keep the pasture and the soil in good condition.

The land capability classification is IIw.

163E—Fayette silt loam, 14 to 18 percent slopes. This moderately steep, well drained soil is on convex side slopes in the loess-covered uplands. Areas range from 5 to 30 acres in size and are elongated and irregularly shaped.

Typically, the surface layer is dark grayish brown, friable silt loam about 6 inches thick. The subsurface layer is brown and yellowish brown, friable silt loam about 6 inches thick. The subsoil is about 43 inches thick. It is yellowish brown and friable. The upper part is silt loam, and the lower part is silty clay loam. The substratum to a depth of about 60 inches is mottled yellowish brown, dark yellowish brown, and grayish brown silt loam.

Included with this soil in mapping are small areas of Keswick and Lindley soils. These soils formed in glacial till, are on the lower part of the side slopes, and are seepy during wet periods. They make up less than 5 percent of the unit.

Permeability is moderate in the Fayette soil, and runoff is rapid. Available water capacity is high. The content of organic matter is about 0.5 to 1.0 percent in the surface layer. Reaction typically is slightly acid or medium acid in the surface layer and subsurface layer and medium acid or strongly acid in the upper part of the subsoil. The subsoil generally has a high supply of available phosphorus and a very low supply of available potassium. In cultivated areas the surface layer tends to crust after hard rains and puddle if tilled when wet.

Most areas are used as woodland. Some are used as permanent pasture. This soil is suited to row crops occasionally grown in rotation with small grain. It is best suited to grasses and legumes for hay and pasture. If cultivated crops are grown, erosion is a serious hazard. A system of conservation tillage that leaves crop residue on the surface and grassed waterways help to prevent excessive soil loss. Tilth generally is fair in the surface layer. Returning crop residue to the soil or regularly adding other organic material improves fertility, helps to prevent surface crusting, and increases the rate of water infiltration.

A cover of pasture plants or hay is effective in controlling erosion. Overgrazing or grazing when the soil is too wet, however, causes surface compaction and poor tilth and increases the runoff rate. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and the soil in good condition.

This soil is moderately well suited to trees. The hazard of erosion and the equipment limitation are severe. Carefully selecting sites for logging trails or roads and laying out the trails or roads on the contour or nearly on the contour help to control erosion. Because of the slope, special logging equipment is needed. Also, caution is needed when this equipment is operated. Woodlots that are used for grazing are subject to compaction and erosion. Grazing also inhibits tree regeneration and causes root damage, which leads to heartrot and other diseases.

The land capability classification is IVe.

163E2—Fayette silt loam, 14 to 18 percent slopes, moderately eroded. This moderately steep, well drained soil is on convex side slopes in the loess-covered uplands. Areas range from 5 to 30 acres in size and are elongated and irregularly shaped.

Typically, the surface layer is dark grayish brown and brown, friable silt loam about 8 inches thick. Because of plowing, it has some streaks and pockets of yellowish brown silty clay loam subsoil material. The subsoil is yellowish brown, friable silty clay loam about 40 inches thick. The substratum to a depth of about 60 inches is mottled yellowish brown, dark yellowish brown, and grayish brown silt loam. In places the surface layer is brown silty clay loam and contains less organic matter because of severe erosion.

Included with this soil in mapping are some small areas of Keswick and Lindley soils. These soils formed in glacial till, are on the lower part of the side slopes, and are seepy during wet periods. They make up less than 5 percent of the unit.

Permeability is moderate in the Fayette soil, and runoff is rapid. Available water capacity is high. The content of organic matter is less than 0.5 percent in the surface layer. Reaction typically is slightly acid or medium acid in the surface layer and medium acid or strongly acid in the upper part of the subsoil. The subsoil generally has a high supply of available phosphorus and a very low supply of available potassium. In cultivated areas the surface layer tends to crust after hard rains and puddle if tilled when wet.

Many areas are cultivated. A few are used for pasture. This soil is suited to row crops occasionally grown in rotation with small grain. It is best suited to grasses and legumes for hay and pasture. If cultivated crops are grown, further erosion is a hazard. A system of conservation tillage that leaves crop residue on the surface and grassed waterways help to prevent excessive soil loss. Tilth generally is fair in the surface layer. Returning crop residue to the soil or regularly adding other organic material improves fertility, helps to prevent surface crusting, and increases the rate of water infiltration.

A cover of pasture plants or hay is effective in controlling erosion. Overgrazing or grazing when the soil is too wet, however, causes surface compaction and poor tilth and increases the runoff rate. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and the soil in good condition.

This soil is moderately well suited to trees. The hazard of erosion and the equipment limitation are moderate. Carefully selecting sites for logging trails or roads and laying out the trails or roads on the contour or nearly on the contour help to control erosion. Because of the slope, special logging equipment is needed. Also, caution is needed when this equipment is operated. Woodlots that are used for grazing are subject to

compaction and erosion. Grazing also inhibits tree regeneration and causes root damage, which leads to heartrot and other diseases.

The land capability classification is IVe.

163E3—Fayette silty clay loam, 14 to 18 percent slopes, severely eroded. This moderately steep, well drained soil is on convex side slopes in the loess-covered uplands. Areas range from 5 to 40 acres in size and are elongated and irregularly shaped.

Typically, the surface layer is brown and yellowish brown, friable silty clay loam about 7 inches thick. Streaks and pockets of dark grayish brown silt loam make up 10 to 15 percent of this layer. The subsoil is yellowish brown, friable silty clay loam about 30 inches thick. The substratum to a depth of about 60 inches is mottled yellowish brown, dark yellowish brown, and grayish brown silt loam.

Included with this soil in mapping are small areas of Keswick and Lindley soils on the lower part of the side slopes. These soils formed in glacial till and are seepy during wet periods. They make up less than 5 percent of the unit.

Permeability is moderate in the Fayette soil, and runoff is rapid. Available water capacity is high. The content of organic matter is less than 0.5 percent in the surface layer. Reaction typically is medium acid or strongly acid in the surface layer and strongly acid in the upper part of the subsoil. The subsoil generally has a high supply of available phosphorus and a very low supply of available potassium. In cultivated areas the surface layer tends to crust after hard rains and puddle if tilled when wet.

Many areas are cultivated. Some are used as permanent pasture. This soil generally is unsuitable for cultivated crops because of a serious hazard of further erosion. The surface layer tends to seal and crust when worked. As a result, the rate of water infiltration is reduced and the runoff rate is increased. The increased runoff rate accelerates sheet and gully erosion. Cultivated crops should be grown only to reestablish grasses and legumes for hay and pasture.

A cover of pasture plants or hay is effective in controlling erosion. Overgrazing or grazing when the soil is too wet, however, causes surface compaction and increases the runoff rate. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and the soil in fairly good condition.

This soil is moderately well suited to trees. Seedlings do not survive and grow well. As a result, they should be planted at close intervals. Thinning the stand helps to provide adequate growing space for the surviving trees. The hazard of erosion and the equipment limitation are moderate. Carefully selecting sites for logging trails and roads and laying out the trails or roads on the contour or nearly on the contour help to control erosion. Because of the slope, special logging equipment is needed. Also, caution is needed when this equipment is operated. Woodlots that are used for grazing are subject to compaction and erosion. Grazing also inhibits tree regeneration and causes root damage, which leads to heartrot and other diseases.

The land capability classification is VIe.

163F—Fayette silt loam, 18 to 25 percent slopes. This steep, well drained soil is on convex side slopes in the loess-covered uplands. Areas range from 5 to 50 acres in size and are elongated and irregularly shaped.

Typically, the surface layer is dark grayish brown, friable silt loam about 6 inches thick. The subsurface layer is brown and yellowish brown, friable silt loam about 4 inches thick. The subsoil is about 41 inches thick. It is friable. The upper part is brown and yellowish brown silt loam, and the lower part is yellowish brown silty clay loam. The substratum to a depth of about 60 inches is mottled yellowish brown, dark yellowish brown, and grayish brown silt loam.

Included with this soil in mapping are small areas of Lindley and Nordness soils on the lower part of the side slopes. Lindley soils formed in glacial till and are seepy during wet periods. Nordness soils are 8 to 20 inches deep over limestone bedrock and are droughty. Included soils make up about 5 to 10 percent of the unit.

Permeability is moderate in the Fayette soil, and runoff is rapid. Available water capacity is high. The content of organic matter is less than 0.5 percent in the surface layer. Reaction typically is slightly acid or medium acid in the surface layer and subsurface layer and medium acid or strongly acid in the upper part of the subsoil. The subsoil generally has a high supply of available phosphorus and a very low supply of available potassium. In cultivated areas the surface layer tends to crust after hard rains and puddle if tilled when wet.

Most areas support native hardwoods. Some are used as permanent pasture. Because of the steep slope and a severe erosion hazard, this soil generally is unsuitable for cultivated crops. It is moderately well suited to hay. Operating farm machinery is difficult because of the slope and because of gullies and drainageways. If cultivated crops are grown, erosion is a serious hazard. Tilth generally is fair in the surface layer.

A cover of pasture plants is effective in controlling erosion. Overgrazing or grazing when the soil is too wet, however, causes surface compaction and increases the runoff rate. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and the soil in good condition.

This soil is moderately well suited to trees. The hazard of erosion and the equipment limitation are moderate. Carefully selecting sites for logging trails or roads and laying out the trails or roads on the contour or nearly on the contour help to control erosion. Because of the slope, special logging equipment is needed. Also,

caution is needed when this equipment is operated. Woodlots that are used for grazing are subject to compaction and erosion. Grazing also inhibits tree regeneration and causes root damage, which leads to heartrot and other diseases.

The land capability classification is VIe.

163G—Fayette silt loam, 25 to 40 percent slopes. This very steep, well drained soil is on short, convex side slopes in the loess-covered uplands. Areas range from 5 to 60 acres in size and are elongated.

Typically, the surface layer is dark grayish brown, friable silt loam about 2 inches thick. The subsurface layer is gray and dark grayish brown, friable silt loam about 3 inches thick. The subsoil is about 30 inches thick. It is friable. The upper part is brown and yellowish brown silt loam, and the lower part is yellowish brown silty clay loam. The substratum to a depth of about 60 inches is yellowish brown silt loam mottled with grayish brown.

Included with this soil in mapping are small areas of Lindley and Nordness soils on the lower part of the side slopes. Lindley soils formed in glacial till and are seepy during wet periods. Nordness soils are 8 to 20 inches deep over limestone bedrock and are droughty. Included soils make up less than 10 percent of the unit.

Permeability is moderate in the Fayette soil, and runoff is rapid. Available water capacity is high. The content of organic matter is less than 0.5 percent in the surface layer. Reaction typically is slightly acid or medium acid in the surface layer and subsurface layer and strongly acid in the upper part of the subsoil. The subsoil generally has a high supply of available phosphorus and a very low supply of available potassium.

Nearly all areas support native hardwoods or are used as permanent pasture. Because of the slope and a severe erosion hazard, this soil is unsuitable for cultivated crops and hay. It is poorly suited to pasture. Ordinary farm machinery cannot be used because of the very steep slope. Tilth generally is fair in the surface layer.

This soil is moderately well suited to trees. The hazard of erosion and the equipment limitation are severe. Carefully selecting sites for logging trails or roads and laying out the trails or roads on the contour or nearly on the contour help to control erosion. Because of the slope, special logging equipment is needed. Also, caution is needed when this equipment is operated. Woodlots that are used for grazing are subject to compaction and erosion. Grazing also inhibits tree regeneration and causes root damage, which leads to heartrot and other diseases.

The land capability classification is VIIe.

175—Dickinson sandy loam, 0 to 2 percent slopes. This nearly level, somewhat excessively drained soil is on stream terraces along the major rivers. Areas range from 3 to 100 acres in size and are irregularly shaped.

Typically, the surface layer is black and very dark brown, friable sandy loam about 8 inches thick. The subsurface layer also is black and very dark brown, friable sandy loam. It is about 4 inches thick. The subsoil is sandy loam about 26 inches thick. The upper part is brown and friable, and the lower part is yellowish brown and very friable. The substratum to a depth of about 60 inches is yellowish brown sand. In places the surface layer and subsoil are loam.

Included with this soil in mapping are small areas of soils that have a silty surface layer and subsoil. These soils are less droughty than the Dickinson soil. They are in landscape positions similar to those of the Dickinson soil. They make up less than 5 percent of the unit.

Permeability is moderately rapid in the upper part of the Dickinson soil and rapid in the lower part. Runoff is slow. Available water capacity is low. The content of organic matter is about 1 to 2 percent in the surface layer. The subsoil typically is slightly acid or medium acid. It generally has a very low supply of available phosphorus and potassium.

Most areas are cultivated. This soil is well suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. It is droughty, however, because of the low available water capacity. Also, wind erosion is a hazard if cultivated crops are grown. A system of conservation tillage that leaves crop residue on the surface conserves moisture and helps to control wind erosion. Good tilth generally can be easily maintained. Returning crop residue to the soil or regularly adding other organic material improves fertility and helps to control wind erosion and prevent deterioration of tilth.

A cover of pasture plants or hay is effective in controlling erosion. Wind erosion is a hazard, however, if overgrazing reduces the extent of the protective plant cover. Proper stocking rates, pasture rotation, and timely deferment of grazing, especially during dry periods, help to keep the pasture and the soil in good condition.

The land capability classification is IIs.

179D2—Gara loam, 9 to 14 percent slopes, moderately eroded. This strongly sloping, well drained soil is on convex side slopes and nose slopes in the uplands. Areas range from 5 to 50 acres in size and are irregularly shaped.

Typically, the surface layer is very dark grayish brown, friable loam about 8 inches thick. Because of plowing, it has some streaks and pockets of the brown subsoil material. The subsoil is about 43 inches thick. The upper part is brown, friable loam, and the lower part is yellowish brown, mottled, firm clay loam. The substratum to a depth of about 60 inches is yellowish brown, mottled clay loam. In places the surface layer is brown, firm clay

loam and contains less organic matter because of severe erosion.

Included with this soil in mapping are small areas of Armstrong soils. These soils are on the upper slopes. They contain more clay in the subsoil than the Gara soil and are seepy during wet periods. They make up less than 10 percent of the unit.

Permeability is moderately slow in the Gara soil, and runoff is rapid. Available water capacity is high. The content of organic matter is about 0.5 to 1.5 percent in the surface layer. This layer typically is medium acid unless it is limed. The subsoil typically is strongly acid to slightly acid. It generally has a low supply of available phosphorus and a very low supply of available potassium.

Many areas are cultivated. Some are used for pasture or hay. Nearly all were cultivated in the past. This soil is poorly suited to corn, soybeans, and small grain and moderately suited to grasses and legumes for hay and pasture. If cultivated crops are grown, further erosion is a moderate hazard. If row crops are grown in most years, soil losses are severe. A system of conservation tillage that leaves crop residue on the surface, terraces, and contour farming help to prevent excessive soil loss. Tilth generally is fair in the surface layer. Returning crop residue to the soil or regularly adding other organic material improves fertility and tilth.

A cover of pasture plants or hay is effective in controlling erosion. Proper stocking rates, pasture rotation, and timely deferment of grazing help to keep the pasture and the soil in good condition.

This soil is moderately suited to trees. Woodlots that are used for grazing are subject to compaction and erosion. Grazing also inhibits tree regeneration and causes root damage, which leads to heartrot and other diseases.

The land capability classification is IVe.

179E2—Gara loam, 14 to 18 percent slopes, moderately eroded. This moderately steep, well drained soil is on convex side slopes in the uplands. Areas range from 5 to 40 acres in size and are irregularly shaped.

Typically, the surface layer is very dark grayish brown, friable loam about 8 inches thick. Because of plowing, it has some streaks and pockets of the brown subsoil material. The subsoil is about 40 inches thick. The upper part is brown, friable loam, and the lower part is yellowish brown, mottled, firm clay loam. The substratum to a depth of about 60 inches is yellowish brown, mottled clay loam. In places the surface layer is brown, firm clay loam and contains less organic matter because of severe erosion.

Included with this soil in mapping are small areas of Armstrong soils on the upper parts of the side slopes. These soils have more clay in the subsoil than the Gara soil and are seepy during wet periods. They make up less than 10 percent of the unit.

Permeability is moderately slow in the Gara soil, and runoff is rapid. Available water capacity is high. The content of organic matter is about 0.5 to 1.0 percent in the surface layer. This layer typically is medium acid unless it is limed. The subsoil typically is strongly acid to slightly acid. It generally has a low supply of available phosphorus and a very low supply of available potassium.

Most areas are used for hay and pasture. Some are cultivated. Very few areas support native hardwoods. Most areas have been cultivated in the past. Because of a severe hazard of erosion, this soil generally is unsuitable for cultivated crops. It is moderately suited to grasses and legumes for hay and pasture. Tilth generally is fair in the surface layer.

A cover of pasture plants or hay is effective in controlling erosion. Proper stocking rates, pasture rotation, and timely deferment of grazing help to keep the pasture and the soil in good condition.

This soil is moderately suited to trees. Erosion and the equipment limitation are the main management concerns. Carefully selecting sites for logging trails or roads and laying out the trails or roads on the contour help to control erosion. Because of the slope, special logging equipment is needed. Also, caution is needed when this equipment is operated. Woodlots that are used for grazing are subject to compaction and erosion. Grazing also inhibits tree regeneration and causes root damage, which leads to heartrot and other diseases.

The land capability classification is VIe.

180—Keomah silt loam, 0 to 2 percent slopes. This nearly level, somewhat poorly drained soil is on the moderately wide tops of upland ridges on the major stream divides. Areas range from 5 to 50 acres in size and are irregularly shaped.

Typically, the surface layer is dark gray, friable silt loam about 7 inches thick. The subsurface layer is dark gray, dark grayish brown, and grayish brown, friable silt loam about 5 inches thick. The subsoil is about 35 inches thick. The upper part is brown, friable silty clay and silty clay loam; the next part is brown and grayish brown, firm silty clay mottled with strong brown; and the lower part is grayish brown and brown, friable silty clay loam. The substratum to a depth of about 60 inches is olive gray silty clay loam. In places the soil is more sloping and is subject to erosion.

Included with this soil in mapping are areas of soils that are on the more nearly level or slightly depressional parts of the landscape. These soils are wetter than the Keomah soil. Also, they have a subsoil that is grayer and contains more clay. They make up about 5 to 10 percent of the unit.

Permeability is slow in the Keomah soil. Runoff also is slow. Available water capacity is high. This soil has a seasonal high water table. The content of organic matter is about 1 to 2 percent in the surface layer. The shrink-

swell potential is high. The subsoil typically is strongly acid. It generally has a medium supply of available phosphorus and a very low supply of available potassium.

Most areas are cultivated. A few areas support native hardwoods. This soil is well suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. If cultivated crops are grown, a drainage system is needed to reduce the wetness. Good tilth generally can be easily maintained. Returning crop residue to the soil or regularly adding other organic material improves fertility, helps to prevent surface crusting and deterioration of tilth, and increases the rate of water infiltration.

A cover of pasture plants or hay is effective in controlling erosion. Overgrazing or grazing during wet periods, however, reduces the extent of the plant cover and causes surface compaction and deterioration of tilth.

This soil is well suited to trees. Woodlots that are used for grazing are subject to compaction. Grazing also inhibits tree regeneration and causes root damage, which leads to heartrot and other diseases.

The land capability classification is IIw.

192C2—Adair silty clay loam, 5 to 9 percent slopes, moderately eroded. This moderately sloping, somewhat poorly drained soil is on convex side slopes in the uplands. Areas are 3 to 10 acres in size and are irregularly shaped.

Typically, the surface layer is very dark grayish brown, friable silty clay loam about 10 inches thick. Because of plowing, it has some streaks and pockets of brown silty clay subsoil material. The subsoil is about 48 inches thick. It has some pebbles throughout. The upper part is mottled brown, grayish brown, and red, very firm silty clay and clay, and the lower part is light brownish gray, firm clay loam mottled with strong brown. The substratum to a depth of about 60 inches is yellowish brown clay loam mottled with light brownish gray. In places the surface layer is thicker and darker and contains more organic matter.

Included with this soil in mapping are small areas of Clarinda soils. These soils are on the upper side slopes, typically above the Adair soil. They do not have pebbles. They are grayer than the Adair soil and are more poorly drained. They make up less than 10 percent of the unit.

Permeability is slow in the Adair soil, and runoff is medium. Available water capacity is high. This soil has a seasonal high water table. The content of organic matter is about 2 to 3 percent in the surface layer. The shrink-swell potential is high. Reaction typically is neutral in the surface layer and medium acid in the upper part of the subsoil. The subsoil generally has a very low supply of available phosphorus and potassium.

Most areas are cultivated or are used for hay or pasture. This soil is moderately suited or poorly suited to corn, soybeans, and small grain. It is moderately suited to grasses and legumes for hay and pasture. If the soil is used for crops, erosion is a severe hazard. It can be controlled, however, by contour farming, terraces, a system of conservation tillage that leaves crop residue on the surface, and crop rotations that include meadow crops. Grassed waterways help to prevent gullying. If terraces are constructed, cuts should be shallow enough to prevent exposure of the clayey subsoil. Seepage can occur in the terrace channels. Tilth generally is good. Returning crop residue to the soil or regularly adding other organic material improves fertility, helps to maintain tilth, and increases the rate of water infiltration.

A cover of pasture plants or hay is effective in controlling erosion. If this soil is used for improved permanent pasture, the organic matter content slowly increases. Pasture management on this seepy soil can be difficult in spring and early summer. Permanent pastures can be improved by renovating and reseeding. Overgrazing or grazing when the soil is wet causes surface compaction, increases the runoff rate, and results in poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and the soil in good condition.

The land capability classification is IIIe.

192D2—Adair silty clay loam, 9 to 14 percent slopes, moderately eroded. This strongly sloping, somewhat poorly drained soil is on convex side slopes in the uplands. Areas are 3 to 10 acres in size and are irregularly shaped.

Typically, the surface layer is very dark grayish brown, friable silty clay loam about 10 inches thick. Because of plowing, it has some streaks and pockets of brown silty clay subsoil material. The subsoil is about 44 inches thick. It has some pebbles throughout. The upper part is mottled brown, grayish brown, and red, very firm silty clay and clay, and the lower part is light brownish gray, firm clay loam mottled with strong brown. The substratum to a depth of about 60 inches is yellowish brown clay loam mottled with light brownish gray. In places the surface layer is brown clay loam and contains less organic matter because of severe erosion.

Included with this soil in mapping are small areas of Clarinda and Shelby soils. Clarinda soils do not have pebbles. They are grayer than the Adair soil and are more poorly drained. Shelby soils contain less clay than the Adair soil. Also, they are not so red and are more permeable. Clarinda soils are higher on the landscape than the Adair soil, and Shelby soils are lower. Included soils make up less than 15 percent of the unit.

Permeability is slow in the Adair soil, and runoff is rapid. Available water capacity is high. This soil has a seasonal high water table. The content of organic matter is about 1.5 to 2.5 percent in the surface layer. The shrink-swell potential is high. Reaction typically is neutral in the surface layer and medium acid in the upper part of

the subsoil. The subsoil generally has a very low supply of available phosphorus and potassium.

Most areas are cultivated. Some are used for hay and pasture. This soil is poorly suited to corn, soybeans, and small grain. It is moderately suited to grasses and legumes for hay and pasture. If the soil is used for cultivated crops, erosion is a severe hazard. It can be controlled, however, by contour farming, terraces, a system of conservation tillage that leaves crop residue on the surface, and crop rotations that include meadow crops. Intensive cultivation causes excessive soil loss. If terraces are constructed, cuts should be shallow enough to prevent exposure of the clayey subsoil. Seepage can occur in the terrace channels. Tilth generally is fair. Returning crop residue to the soil or regularly adding other organic material improves fertility and tilth and increases the rate of water infiltration.

A cover of pasture plants or hay is effective in controlling erosion. If this soil is used for improved permanent pasture, the organic matter content slowly increases. Pasture management on this seepy soil can be difficult in spring and early summer. Permanent pastures can be improved by renovating and reseeding. Overgrazing or grazing when the soil is wet causes surface compaction, increases the runoff rate, and results in poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and the soil in good condition.

The land capability classification is IVe.

219—Jackson silt loam, 0 to 2 percent slopes. This nearly level, moderately well drained soil is on terraces along the major streams and rivers. It is subject to rare flooding. Areas range from 3 to 20 acres in size and are irregularly shaped.

Typically, the surface layer is very dark grayish brown, friable silt loam about 6 inches thick. The subsurface layer is dark grayish brown, friable silt loam about 6 inches thick. The subsoil is about 39 inches thick. The upper part is brown and dark yellowish brown, friable silt loam; the next part is dark yellowish brown, friable silt loam mottled with light brownish gray; and the lower part is brown and strong brown, friable, stratified silt loam, loam, and fine sandy loam mottled with grayish brown. The substratum to a depth of about 60 inches is brown and strong brown, stratified fine sandy loam, loam, and sand mottled with grayish brown. In places the surface layer is thicker and darker and contains more organic matter.

Permeability is moderate in the upper part of the profile and rapid in the lower part. Runoff is slow. Available water capacity is high. This soil has a seasonal high water table. The content of organic matter is about 1 to 3 percent in the surface layer. Reaction typically is neutral in the surface layer and subsurface layer and medium acid in the subsoil. The subsoil generally has a medium supply of available phosphorus and a low supply of available potassium.

Most areas are cultivated or are used for pasture. Some areas support native hardwoods. This soil is well suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. If cultivated crops are grown, the hazard of erosion is normally slight. A system of conservation tillage that leaves crop residue on the surface helps to prevent excessive soil loss. Good tilth generally can be easily maintained. Returning crop residue to the soil or regularly adding other organic material improves fertility, helps to prevent surface crusting, and increases the rate of water infiltration.

A cover of pasture plants or hay is effective in controlling erosion. Overgrazing or grazing when the soil is too wet, however, causes surface compaction and increases the likelihood of puddling. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and the soil in good condition.

This soil is well suited to trees. No major hazards or limitations affect planting if the proper species are selected and the stand is managed properly. Woodlots that are used for grazing are subject to compaction. Grazing also inhibits tree regeneration and causes root damage, which leads to heartrot and other diseases.

The land capability classification is I.

220—Nodaway silt loam, 0 to 2 percent slopes. This nearly level, moderately well drained soil is in areas of recent deposition on bottom land. It is occasionally flooded. Areas are irregularly shaped. They generally range from 5 to 100 acres in size, but some are as large as 250 acres.

Typically, the surface layer is very dark grayish brown, friable silt loam about 8 inches thick. The substratum to a depth of about 60 inches is stratified very dark gray, dark grayish brown, and grayish brown silt loam. In places some strata of sand are in the substratum. In some areas a dark buried soil of silty clay loam is at a depth of 20 to 36 inches.

Permeability is moderate, and runoff is slow. Available water capacity is high. This soil has a seasonal high water table. The content of organic matter is about 1 to 2 percent in the surface layer. The substratum typically is slightly acid throughout. It generally has a medium supply of available phosphorus and a low or very low supply of available potassium.

This soil is cultivated, pastured, or wooded. It is well suited to corn, soybeans, and small grain. The flooding and the seasonal high water table are the main management concerns. Measures that reduce the wetness improve the timeliness of fieldwork. Good tilth generally can be easily maintained. Returning crop residue to the soil or regularly adding other organic material helps to maintain tilth, improves fertility, helps to

prevent surface crusting, and increases the rate of water infiltration.

This soil is well suited to grasses and legumes for hay and pasture. Overgrazing reduces forage production.

This soil is moderately well suited to trees. Seedlings survive and grow well only if they are protected from flooding. Few other hazards or limitations affect planting or harvesting. Woodlots that are used for grazing are subject to compaction. Grazing also inhibits tree regeneration and causes root damage, which leads to heartrot and other diseases.

The land capability classifications IIw.

222C2—Clarinda silty clay loam, 5 to 9 percent slopes, moderately eroded. This moderately sloping, poorly drained soil is on short, concave side slopes and in coves at the head of drainageways in the uplands. Areas range from 5 to 20 acres in size and are irregularly shaped.

Typically, the surface layer is very dark gray, friable silty clay loam about 11 inches thick. Because of plowing, it has some streaks and pockets of gray silty clay subsoil material. The subsoil to a depth of about 60 inches is gray, very firm silty clay. The upper part has a few reddish brown and strong brown mottles, and the lower part has light olive brown mottles.

Included with this soil in mapping are areas of the moderately well drained Nira soils on the upper part of the side slopes. These soils formed in deoxidized loess and contain less clay in the subsoil than the Clarinda soil. They make up about 10 percent of the unit.

Permeability is very slow in the clayey subsoil of the Clarinda soil. As a result, seepage is likely. Runoff is medium. Available water capacity is high. This soil has a seasonal high water table. The content of organic matter is about 2 to 3 percent in the surface layer. The shrink-swell potential is high. Reaction typically is neutral in the surface layer and slightly acid in the upper part of the subsoil. The subsoil generally has a very low supply of available phosphorus and potassium.

Most areas are cultivated or have been cultivated in the past. Some are used for hay or pasture. This soil generally is farmed along with the adjoining soils. It is poorly suited to corn, soybeans, and small grain and moderately suited to grasses and legumes for hay and pasture. If cultivated crops are grown, the wetness is a very serious limitation. Also, further erosion is a severe hazard. A system of conservation tillage that leaves crop residue on the surface helps to prevent excessive soil loss. If terraces are constructed, cuts should be shallow enough to prevent exposure of the clayey subsoil. Installing interceptor tile in the more permeable soils upslope reduces the wetness in many areas of this soil. Tilth generally is fair in the surface layer. Returning crop residue to the soil or regularly adding other organic material and deferring tillage when the soil is wet improve fertility and tilth.

A cover of pasture plants or hay is effective in controlling erosion. Proper stocking rates, pasture rotation, and timely deferment of grazing help to keep the pasture and the soil in good condition.

The land capability classification is IVw.

222C3—Clarinda silty clay loam, 5 to 9 percent slopes, severely eroded. This moderately sloping, poorly drained soil is on short, plane or convex side slopes in the uplands. Areas range from 5 to 20 acres in size and are irregularly shaped.

Typically, the surface layer is gray, firm silty clay loam about 8 inches thick. Streaks and pockets of very dark gray soil material make up 10 to 15 percent of this layer. The subsoil to a depth of about 60 inches is gray, very firm silty clay. The upper part has a few reddish brown and strong brown mottles, and the lower part has light olive brown mottles. In some small areas the surface layer is silty clay.

Included with this soil in mapping are areas of the moderately well drained Nira soils on the upper part of the side slopes. These soils formed in deoxidized loess and contain less clay in the subsoil than the Clarinda soil. They make up about 10 percent of the unit.

Permeability is very slow in the clayey subsoil of the Clarinda soil. As a result, seepage is likely. Runoff is rapid. Available water capacity is high. This soil has a seasonal high water table. The content of organic matter is about 0.5 to 1.5 percent in the surface layer. The shrink-swell potential is high in the subsoil. Reaction typically is slightly acid in the surface layer and in the upper part of the subsoil. The subsoil generally has a very low supply of available phosphorus and potassium.

All areas are cultivated or have been cultivated in the past. Some are used for hay or pasture. This soil generally is farmed along with the adjoining soils. It generally is unsuited to corn, soybeans, and small grain and moderately suited to grasses and legumes for hay and pasture. The wetness is a very serious limitation. Also, further erosion is a severe hazard. Surface crusting is a problem on this severely eroded soil. It adversely affects seedling emergence. The surface layer tends to seal and crust when worked. As a result, the rate of water infiltration is reduced and the runoff rate is increased. The increased runoff rate accelerates sheet and gully erosion.

A cover of pasture plants or hay is effective in controlling erosion. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and the soil in good condition.

The land capability classification is VIe.

222D2—Clarinda silty clay loam, 9 to 14 percent slopes, moderately eroded. This strongly sloping, poorly drained soil is on short, concave side slopes and in coves at the head of drainageways in the uplands.

Areas range from 5 to 25 acres in size and are irregularly shaped.

Typically, the surface layer is very dark gray, friable silty clay loam about 10 inches thick. Because of plowing, it has some streaks and pockets of gray silty clay subsoil material. The subsoil to a depth of about 60 inches is gray, very firm silty clay. The upper part has a few reddish brown and strong brown mottles, and the lower part has light olive brown mottles.

Included with this soil in mapping are small areas of the moderately well drained Nira soils. These soils are on the upper part of the side slopes. They formed in deoxidized loess and contain less clay throughout the subsoil than the Clarinda soil. They make up about 10 percent of the unit.

Permeability is very slow in the clayey subsoil of the Clarinda soil. As a result, seepage is likely. Runoff is rapid. Available water capacity is high. This soil has a seasonal high water table. The content of organic matter is about 1.5 to 2.0 percent in the surface layer. The shrink-swell potential is high. Reaction typically is neutral in the surface layer and slightly acid in the upper part of the subsoil. The subsoil generally has a very low supply of available phosphorus and potassium.

Most areas are cultivated or have been cultivated in the past. Some are used for hay or pasture. This soil generally is farmed along with the adjoining soils. It is poorly suited to corn, soybeans, and small grain and moderately suited to grasses and legumes for hay and pasture. If cultivated crops are grown, the wetness is a very serious limitation. Also, further erosion is a severe hazard. A system of conservation tillage that leaves crop residue on the surface helps to prevent excessive soil loss. If terraces are constructed, cuts should be shallow enough to prevent exposure of the clayey subsoil. Installing interceptor tile in the more permeable soils upslope reduces the wetness in many areas of this soil. Tilth generally is fair in the surface layer. Returning crop residue to the soil or regularly adding other organic material and deferring tillage when the soil is wet improve fertility and tilth.

A cover of pasture plants or hay is effective in controlling erosion. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and the soil in good condition.

The land capability classification is IVe.

222D3—Clarinda silty clay loam, 9 to 14 percent slopes, severely eroded. This strongly sloping, poorly drained soil is on short side slopes and in coves at the head of upland drainageways. Areas range from 5 to 25 acres in size and are irregularly shaped.

Typically, the surface layer is gray, firm silty clay loam about 8 inches thick. Very dark gray streaks and pockets make up 10 to 15 percent of this layer. The subsoil to a depth of about 60 inches is gray, very firm silty clay. The upper part has a few reddish brown and strong brown mottles, and the lower part has light olive brown mottles. In places the surface layer is silty clay.

Included with this soil in mapping are areas of the moderately well drained Nira soils. These soils are on the upper parts of the side slopes. They formed in deoxidized loess and contain less clay in the subsoil than the Clarinda soil. They make up about 10 percent of the unit.

Permeability is very slow in the clayey subsoil of the Clarinda soil. As a result, seepage is likely. Runoff is rapid. Available water capacity is high. This soil has a seasonal high water table. The content of organic matter is about 0.5 to 1.0 percent in the surface layer. The shrink-swell potential is high. Reaction typically is slightly acid in the surface layer and the upper part of the subsoil. The subsoil generally has a very low supply of available phosphorus and potassium.

Most areas are cultivated. Almost all areas have been cultivated in the past. Some are used for hay or pasture. This soil generally is farmed along with the adjoining soils. It generally is unsuited to corn, soybeans, and small grain and moderately suited to grasses and legumes for hay and pasture. The wetness is a very serious limitation. Also, further erosion is a severe hazard if cultivated crops are grown. Surface crusting is a problem on this severely eroded soil. It adversely affects seedling emergence. The surface layer tends to seal and crust when worked. As a result, the rate of water infiltration is reduced and the runoff rate is increased. The increased runoff rate accelerates sheet and gully erosion.

A cover of pasture plants or hay is effective in controlling erosion. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and the soil in good condition.

The land capability classification is VIe.

223C2—Rinda silty clay loam, 5 to 9 percent slopes, moderately eroded. This moderately sloping, poorly drained soil is on convex or plane side slopes and in coves at the head of upland drainageways. Areas range from 3 to 15 acres in size and are irregularly shaped.

Typically, the surface layer is very dark gray, friable silty clay loam about 7 inches thick. Because of plowing, it has some streaks and pockets of the dark grayish brown subsoil material. The upper part of the subsoil is dark grayish brown, friable silty clay loam. The next part is grayish brown and dark gray, firm and very firm silty clay. The lower part to a depth of about 60 inches is mottled grayish brown and light brownish gray, firm silty clay. In some places the surface layer is silt loam. In other places it is silty clay and contains less organic matter because of severe erosion.

Included with this soil in mapping are areas of the moderately well drained Hedrick soils on the upper slopes. These soils have less clay in the subsoil than the Rinda soil. They make up about 5 to 10 percent of the unit.

Permeability is very slow in the Rinda soil, and runoff is medium. Available water capacity is high. This soil has a seasonal high water table. The content of organic matter is about 1 to 2 percent in the surface layer. The shrink-swell potential is high. The subsoil typically is medium acid in the upper part. It generally has a very low supply of available phosphorus and potassium.

Most areas are cultivated or have been cultivated in the past. Some are used for hay or pasture. Very few areas support native hardwoods. This soil generally is farmed along with the adjoining soils. It is poorly suited to corn, soybeans, and small grain and moderately suited to grasses and legumes for hay and pasture. If cultivated crops are grown, the wetness is a very serious limitation. Also, further erosion is a severe hazard. A system of conservation tillage that leaves crop residue on the surface helps to prevent excessive soil loss. If terraces are constructed, cuts should be shallow enough to prevent exposure of the clayey subsoil. Installing interceptor tile in the more permeable soils upslope reduces the wetness in many areas of this soil. Tilth generally is fair in the surface layer. Returning crop residue to the soil or regularly adding other organic material improves fertility and tilth.

A cover of pasture plants or hay is effective in controlling erosion. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and the soil in good condition.

This soil is poorly suited to trees because of the wetness. The main management concerns are the equipment limitation, seedling mortality, and the windthrow hazard. Logging equipment should be used only during the drier periods or during the winter, when the ground is frozen. Because they do not survive and grow well, seedlings should be planted at close intervals. Thinning the stand helps to provide adequate growing space for the surviving trees. The windthrow hazard is caused by a shallow rooting depth. Woodlots that are used for grazing are subject to compaction and erosion. Grazing also inhibits tree regeneration and causes root damage, which leads to heartrot and other diseases.

The land capability classification is IVw.

223D2—Rinda silty clay loam, 9 to 14 percent slopes, moderately eroded. This strongly sloping, poorly drained soil is on side slopes and in coves at the head of upland drainageways. Areas range from 5 to 30 acres in size and are irregularly shaped.

Typically, the surface layer is very dark gray, friable silty clay loam about 7 inches thick. Because of plowing, it has some streaks and pockets of dark grayish brown subsoil material. The upper part of the subsoil is dark grayish brown, friable silty clay loam; the next part is grayish brown and dark gray, firm and very firm silty clay; and the lower part to a depth of about 60 inches is mottled grayish brown and light brownish gray, firm silty clay. In some places the surface layer is silt loam. In other places it is silty clay and contains less organic matter because of severe erosion.

Included with this soil in mapping are small areas of the moderately well drained Hedrick soils on the upper part of the side slopes. These soils formed in gray, deoxidized loess and contain less clay throughout the subsoil than the Rinda soil. They make up about 10 percent of the unit.

Permeability is very slow in the Rinda soil, and runoff is rapid. Available water capacity is high. The content of organic matter is about 1.0 to 1.5 percent in the surface layer. The shrink-swell potential is high. The subsoil typically is medium acid in the upper part. It generally has a very low supply of available phosphorus and potassium.

Most areas are cultivated. Many are used for hay and pasture. A few are wooded. Areas of this soil are generally so small that they are farmed along with the adjoining soils. The soil is poorly suited to corn, soybeans, and small grain and moderately suited to grasses and legumes for hay and pasture. If cultivated crops are grown, the wetness is a serious limitation. Also, further erosion is a very severe hazard. A system of conservation tillage that leaves crop residue on the surface helps to prevent excessive soil loss. If terraces are constructed, cuts should be shallow enough to prevent exposure of the clayey subsoil. Installing interceptor tile in the more permeable soils upslope reduces the wetness in many areas of this soil. Tilth generally is fair in the surface layer. Returning crop residue to the soil or regularly adding other organic material improves fertility and tilth.

A cover of pasture plants or hay is effective in controlling erosion. Where the gray, clayey subsoil is exposed, establishing most kinds of vegetation is difficult. Pasture management can be difficult in spring and early summer. Permanent pastures can be improved by renovating and reseeding. Overgrazing or grazing when the soil is wet causes surface compaction, increases the runoff rate, and results in poorer tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and the soil in good condition.

This soil is poorly suited to trees because of the wetness. The main management concerns are the equipment limitation, seedling mortality, and the windthrow hazard. Logging equipment should be used only during the drier periods or during the winter, when the ground is frozen. Because they do not survive well, seedlings should be planted at close intervals. Thinning the stand helps to provide adequate growing space for

the surviving trees. The windthrow hazard is caused by a shallow rooting depth. Woodlots that are used for grazing are subject to compaction and erosion. Grazing also inhibits tree regeneration and causes root damage, which leads to heartrot and other diseases.

The land capability classification is IVe.

263—Okaw silt loam, 0 to 2 percent slopes. This nearly level, very poorly drained soil is on stream terraces along the major and minor streams. It is subject to ponding and rare flooding. Areas range from 3 to 25 acres in size and are irregularly shaped.

Typically, the surface layer is dark grayish brown, friable silt loam about 7 inches thick. The subsurface layer is light brownish gray, mottled, friable silt loam about 9 inches thick. The subsoil is about 29 inches thick. It is firm and mottled. The upper part is grayish brown silty clay, and the lower part is light brownish gray silty clay and silty clay loam. The substratum to a depth of about 60 inches is light brownish gray, mottled silty clay loam.

Included with this soil in mapping are small areas of soils that have a mottled brown and grayish brown subsoil. These soils have less clay in the upper part of the subsoil than the Okaw soil. Also, they are better drained. They make up about 5 to 10 percent of the unit.

Permeability is very slow in the Okaw soil, and runoff is slow to ponded. Available water capacity is high. This soil has a seasonal high water table. The content of organic matter is about 1 to 2 percent in the surface layer. The shrink-swell potential is high. The subsoil typically is very strongly acid or strongly acid in the upper part. It generally has a very low supply of available phosphorus and potassium.

Many areas are cultivated. Some are used for hay and pasture. A few support native hardwoods. This soil is moderately suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. A subsurface drainage system may be beneficial but generally functions slowly. In many places diversion terraces at the base of the slope help to control the runoff from the higher areas. Tilth generally is poor in the surface layer. Returning crop residue to the soil or regularly adding other organic material and deferring tillage when the soil is wet improve fertility and help to prevent deterioration of tilth.

Pasture management is difficult because of the wetness. Permanent pasture can be improved by renovating or reseeding. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and the soil in good condition.

This soil is moderately suited to trees. The main management concerns are the equipment limitation, seedling mortality, and the windthrow hazard. Logging equipment should be used only during the drier periods or during the winter, when the ground is frozen. Because they do not survive well, seedlings should be planted at close intervals. Thinning the stand helps to provide adequate growing space for the surviving trees. A drainage system that lowers the water table helps to prevent windthrow. Woodlots that are used for grazing are subject to compaction. Grazing also inhibits tree regeneration and causes root damage, which leads to heartrot and other diseases.

The land capability classification is IIIw.

264B—Ainsworth silt loam, 1 to 5 percent slopes. This gently sloping, moderately well drained soil is on convex slopes on stream terraces. It is subject to rare flooding. Areas range from 2 to 15 acres in size and are irregularly shaped.

Typically, the surface layer is dark grayish brown and brown, friable silt loam about 9 inches thick. The subsoil is about 39 inches thick. The upper part is brown, dark yellowish brown, and yellowish brown, firm silty clay loam; the next part is yellowish brown and brown, friable silty clay loam that has a few light brownish gray and strong brown mottles; and the lower part is yellowish brown, friable sandy loam. The substratum to a depth of about 60 inches is yellowish brown loamy sand. In some eroded areas the surface layer has some silty clay loam subsoil material.

Included with this soil in mapping are small areas of Okaw soils. These soils have more clay in the subsoil than the Ainsworth soil and are grayer. They are very poorly drained and are in the more nearly level areas. They make up less than 5 percent of the unit.

Permeability is moderately slow in the upper part of the Ainsworth soil and rapid in the lower part. Runoff is medium. Available water capacity is high. The content of organic matter is about 1.5 to 2.5 percent in the surface layer. The subsoil typically is slightly acid or medium acid in the upper part. It generally has a high supply of available phosphorus and a low supply of available potassium.

Most areas are cultivated. A few small areas support trees. This soil is moderately well suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. Most areas are farmed along with the surrounding soils because they are too small to be managed separately. If cultivated crops are grown, erosion is a hazard. Although contour farming and terraces can help to control erosion, applying these measures may be impractical because the surrounding soils are nearly level and are not subject to erosion. Crop rotations that include meadow crops and a system of conservation tillage that leaves crop residue on the surface help to control erosion. Good tilth can be easily maintained. Returning crop residue to the soil or regularly adding other organic material improves fertility, helps to prevent crusting, and increases the rate of water infiltration.

A cover of pasture plants or hay is effective in controlling erosion. Overgrazing or grazing when the soil is too wet, however, causes surface compaction, increases the runoff rate, results in poor tilth, and reduces forage production. Proper stocking rates, pasture rotation, and timely deferment of grazing help to keep the pasture and the soil in good condition.

This soil is well suited to trees. No major hazards or limitations affect planting if the proper species are selected and the stand is managed properly. Woodlots that are used for grazing are subject to compaction and erosion. Grazing also inhibits tree regeneration and causes root damage, which leads to heartrot and other diseases.

The land capability classification is IIe.

269—Humeston silty clay loam, 0 to 2 percent slopes. This nearly level, very poorly drained soil is in slightly concave areas on slack-water bottom land. It is occasionally flooded. Areas range from 5 to more than 30 acres in size and are irregularly shaped.

Typically, the surface layer is very dark gray, friable silty clay loam about 7 inches thick. The subsurface layer is about 13 inches thick. It is friable. The upper part is very dark gray silty clay loam, and the lower part is dark gray silt loam. The subsoil extends to a depth of more than 60 inches. The upper part is very dark gray and dark gray, firm silty clay loam and very firm silty clay; the next part is very dark gray and dark gray, very firm silty clay; and the lower part is dark gray and gray, mottled, firm silty clay loam. In places the soil does not have a silt loam subsurface layer.

Permeability and runoff are very slow. Available water capacity is high. This soil has a seasonal high water table. The content of organic matter is about 3 to 4 percent in the surface layer. The shrink-swell potential is high. The surface layer typically is medium acid. The subsoil generally has a medium supply of available phosphorus and a very low supply of available potassium.

This soil is used mostly for cultivated crops, hay, and pasture. It is moderately suited to corn, soybeans, and small grain. Row crops can be grown in many years if the soil is adequately drained. Tile drains generally do not function satisfactorily, and flooding limits their use in the low areas. Open ditches, surface drains, land shaping, and bedding help to remove surface water. The soil warms up slowly in the spring and dries slowly after rains. In years when rainfall is heavy, planting is delayed. Because the soil is fairly difficult to manage, fieldwork should be timely. Tilth generally is fair. An occasional year of meadow improves tilth and helps to control weeds and insects.

This soil is moderately suited to grasses and legumes for hay and pasture. Permanent pastures can be improved by renovating and reseeding. Overgrazing or grazing when the soil is wet causes surface compaction and results in poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and the soil in good condition.

The land capability classification is IIIw.

279—Taintor silty clay loam, 0 to 2 percent slopes. This nearly level, poorly drained soil is on broad upland divides. Areas range from 5 to 200 acres in size and are irregularly shaped.

Typically, the surface layer is black, friable silty clay loam about 8 inches thick. The subsurface layer is black and very dark gray, firm silty clay loam about 14 inches thick. The subsoil is about 27 inches thick. The upper part is grayish brown and olive gray, firm silty clay and silty clay loam, and the lower part is olive gray and light olive gray, firm and friable silty clay loam. The substratum to a depth of about 60 inches is olive gray and light olive gray silty clay loam.

Included with this soil in mapping are small areas of the somewhat poorly drained Mahaska soils. These soils are on slight rises. They make up less than 5 percent of the unit.

Permeability is moderately slow in the Taintor soil, and runoff is slow. Available water capacity is high. This soil has a seasonal high water table. The content of organic matter is about 5 to 6 percent in the surface layer. The shrink-swell potential is high. The subsoil typically is medium acid or slightly acid. It generally has a very low supply of available phosphorus and potassium.

Most areas are cultivated. This soil is well suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. If the soil is adequately drained, row crops can be grown in most years. A drainage system is needed to reduce the wetness and provide aeration and a deep root zone for plants. Tile drains generally function satisfactorily, but in some areas suitable outlets are not available. Tilth generally is fair in the surface layer. Returning crop residue to the soil and deferring tillage when the soil is wet improve tilth.

A cover of pasture plants or hay is effective in controlling erosion. Overgrazing or grazing when the soil is wet, however, causes surface compaction and poor tilth. Proper stocking rates, pasture rotation, and timely deferment of grazing or restricted use during wet periods help to keep the pasture and the soil in good condition.

The land capability classification is IIw.

280—Mahaska silty clay loam, 0 to 2 percent slopes. This nearly level, somewhat poorly drained soil is on narrow flats and the moderately wide or wide tops of ridges in the uplands. Areas range from 10 to more than 200 acres in size and are irregularly shaped.

Typically, the surface layer is black, friable silty clay loam about 8 inches thick. The subsurface layer is black and very dark grayish brown, firm silty clay loam about 9 inches thick. The subsoil to a depth of about 60 inches

is firm silty clay loam. The upper part is dark grayish brown and light olive brown, the next part is light olive gray and mottled, and the lower part is gray and mottled. In places the soil is more sloping and is subject to erosion.

Included with this soil in mapping are some areas of the poorly drained Taintor soils. These soils are on broad flats in the slightly lower areas. They make up less than 10 percent of the unit.

Permeability is moderate in the Mahaska soil, and runoff is slow. Available water capacity is high. This soil has a seasonal high water table. The content of organic matter is about 5 to 6 percent in the surface layer. The subsoil typically is medium acid to very strongly acid. It generally has a medium supply of available phosphorus and a low supply of available potassium.

Most areas are cultivated. This soil is well suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. Row crops can be grown in most years. Most areas are adequately drained. In some areas, however, tile drains are needed to improve the timeliness of fieldwork in wet years. If cultivated, some areas are subject to erosion. Good tilth generally can be easily maintained. Returning crop residue to the soil and delaying fieldwork when the soil is wet help to prevent deterioration of tilth.

A cover of pasture plants or hay is effective in controlling erosion. Overgrazing or grazing when the soil is wet, however, causes surface compaction and poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and the soil in good condition.

The land capability classification is I.

281B—Otley silty clay loam, 2 to 5 percent slopes. This gently sloping, moderately well drained soil is on convex ridgetops and side slopes in the loess-covered uplands, generally adjacent to broad flats. Areas range from 5 to more than 100 acres in size and are irregularly shaped.

Typically, the surface layer is very dark brown and black, friable silty clay loam about 8 inches thick. The subsurface layer is black and very dark grayish brown, friable silty clay loam about 10 inches thick. The subsoil to a depth of about 60 inches is firm silty clay loam. The upper part is brown, the next part is brown and mottled, and the lower part is mottled yellowish brown, light brownish gray, and strong brown.

Included with this soil in mapping are small areas of the somewhat poorly drained Mahaska soils. These soils are in the less sloping areas and are wetter than the Otley soil. They make up less than 10 percent of the unit.

Permeability is moderate in the Otley soil, and runoff is medium. Available water capacity is high. The content of organic matter is about 3 to 4 percent in the surface layer. The subsoil typically is medium acid or strongly acid. It generally has a low supply of available phosphorus and a very low supply of available potassium.

Most areas are cultivated. This soil is suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. If cultivated crops are grown, erosion is a hazard. It can be controlled, however, by contour farming, terraces, a system of conservation tillage that leaves crop residue on the surface, and crop rotations that include meadow crops. Good tilth generally can be easily maintained. Returning crop residue to the soil or regularly adding other organic material improves fertility and helps to prevent deterioration of tilth.

A cover of pasture plants or hay is effective in controlling erosion. Overgrazing or grazing when the soil is too wet, however, causes surface compaction, increases the runoff rate, results in poor tilth, and reduces forage production. Proper stocking rates, pasture rotation, and timely deferment of grazing help to keep the pasture and the soil in good condition.

The land capability classification is IIe.

281B2—Otley silty clay loam, 2 to 5 percent slopes, moderately eroded. This gently sloping, moderately well drained soil is on convex ridgetops and side slopes in the loess-covered uplands, generally adjacent to broad flats. Areas range from 5 to 20 acres in size and are irregularly shaped.

Typically, the surface layer is very dark brown and black, friable silty clay loam about 10 inches thick. Because of plowing, it has some streaks and pockets of brown subsoil material. The subsoil to a depth of about 60 inches is firm silty clay loam. The upper part is brown, the next part is brown and mottled, and the lower part is mottled yellowish brown, light brownish gray, and strong brown. In places the surface layer is brown, firm silty clay loam and is lower in content of organic matter because of severe erosion.

Included with this soil in mapping are small areas of the somewhat poorly drained Mahaska soils. These soils are in the less sloping areas and are wetter than the Otley soil. They make up less than 10 percent of the unit.

Permeability is moderate in the Otley soil, and runoff is medium. Available water capacity is high. The content of organic matter is about 2 to 3 percent in the surface layer. The subsoil typically is medium acid or strongly acid. It generally has a low supply of available phosphorus and a very low supply of available potassium.

Most areas are cultivated. This soil is suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. If cultivated crops are grown, further erosion is a hazard. It can be controlled, however, by contour farming, terraces, a system of conservation tillage that leaves crop residue on the surface, and crop

rotations that include meadow crops. Tilth generally is fair. Returning crop residue to the soil or regularly adding other organic material improves fertility and helps to prevent deterioration of tilth.

A cover of pasture plants or hay is effective in controlling erosion. Overgrazing or grazing when the soil is too wet, however, causes surface compaction, increases the runoff rate, results in poor tilth, and reduces forage production. Proper stocking rates, pasture rotation, and timely deferment of grazing help to keep the pasture and the soil in good condition.

The land capability classification is IIe.

281C—Otley silty clay loam, 5 to 9 percent slopes. This moderately sloping, moderately well drained soil is on loess-covered ridges and side slopes in the uplands. Areas range from 5 to 30 acres in size and are irregularly shaped.

Typically, the surface layer is very dark brown and black, friable silty clay loam about 8 inches thick. The subsurface layer is black and very dark grayish brown, friable silty clay loam about 6 inches thick. The subsoil to a depth of about 60 inches is firm silty clay loam. The upper part is brown, the next part is brown and mottled, and the lower part is yellowish brown and mottled. In places the subsoil is light brownish gray and has large accumulations of iron.

Included with this soil in mapping are small areas of Clarinda soils, which make up less than 2 percent of the unit. These soils are poorly drained, are very slowly permeable, and are on the lower parts of the side slopes. The lower areas adjacent to these soils are seepy during wet periods.

Permeability is moderate in the Otley soil, and runoff is medium. Available water capacity is high. The content of organic matter is about 3 to 4 percent in the surface layer. The subsoil typically is medium acid or strongly acid. It generally has a low supply of available phosphorus and a very low supply of available potassium.

Most areas are cultivated. Some are used for hay or pasture. This soil is moderately suited to corn, soybeans, and small grain and well suited to grasses and legumes for hay and pasture. If cultivated crops are grown, erosion is a hazard. A system of conservation tillage that leaves crop residue on the surface, contour farming, and terraces help to prevent excessive soil loss. Good tilth generally can be easily maintained. Returning crop residue to the soil or regularly adding other organic material improves fertility and tilth.

A cover of pasture plants or hay is effective in controlling erosion. Proper stocking rates, pasture rotation, and timely deferment of grazing help to keep the pasture and the soil in good condition.

The land capability classification is IIIe.

281C2—Otley silty clay loam, 5 to 9 percent slopes, moderately eroded. This moderately sloping, moderately well drained soil is on loess-covered ridgetops and side slopes in the uplands. Areas range from 5 to more than 100 acres in size and are irregularly shaped.

Typically, the surface layer is very dark brown and black, friable silty clay loam about 10 inches thick. Because of plowing, it has some brown subsoil material. The subsoil is firm silty clay loam about 45 inches thick. The upper part is brown, the next part is brown and mottled, and the lower part is mottled yellowish brown, light brownish gray, and strong brown. The substratum to a depth of about 60 inches is mottled light brownish gray, strong brown, and yellowish brown silt loam. In some places the subsoil is light brownish gray and has large accumulations of iron. In other places the surface layer is brown, firm silty clay loam and is lower in content of organic matter because of severe erosion.

Included with this soil in mapping are small areas of Clarinda soils, which make up less than 2 percent of the unit. These soils are poorly drained, are very slowly permeable, and are on the lower parts of the side slopes. The lower areas adjacent to these soils are seepy during wet periods.

Permeability is moderate in the Otley soil, and runoff is medium. Available water capacity is high. The content of organic matter is about 2 to 3 percent in the surface layer. The subsoil typically is medium acid or strongly acid. It generally has a low supply of available phosphorus and a very low supply of available potassium.

Most areas are cultivated. Some are used for hay or pasture. This soil is moderately suited to corn, soybeans, and small grain and well suited to grasses and legumes for hay and pasture. If cultivated crops are grown, further erosion is a hazard. A system of conservation tillage that leaves crop residue on the surface during the winter, contour farming, and terraces help to prevent excessive soil loss. In places, however, contour farming or terracing is difficult because of short, irregular slopes. Tilth generally is fair in the surface layer. Returning crop residue to the soil or regularly adding other organic material improves fertility and tilth.

A cover of pasture plants or hay is effective in controlling erosion. Proper stocking rates, pasture rotation, and timely deferment of grazing help to keep the pasture and the soil in good condition.

The land capability classification is IIIe.

281C3—Otley silty clay loam, 5 to 9 percent slopes, severely eroded. This moderately sloping, moderately well drained soil is on loess-covered ridgetops and side slopes in the uplands. Areas range from 5 to 40 acres in size and are irregularly shaped.

Typically, the surface layer is brown, firm silty clay loam about 8 inches thick. Very dark grayish brown and

black streaks and pockets make up 10 to 15 percent of this layer. The subsoil is firm silty clay loam about 31 inches thick. The upper part is brown, the next part is brown and mottled, and the lower part is mottled yellowish brown, light brownish gray, and strong brown. The substratum to a depth of about 60 inches is mottled light brownish gray, strong brown, and yellowish brown silt loam. In places the subsoil and substratum are light brownish gray and have large accumulations of iron.

Included with this soil in mapping are some small areas of Clarinda soils, which make up less than 2 percent of the unit. These soils are poorly drained, are very slowly permeable, and are on the lower parts of the side slopes. The lower areas adjacent to these soils are seepy during wet periods.

Permeability is moderate in the Otley soil, and runoff is rapid. Available water capacity is high. The content of organic matter is about 0.5 to 2.0 percent in the surface layer. The subsoil typically is medium acid or strongly acid. It generally has a low supply of available phosphorus and a very low supply of available potassium.

Most areas are cultivated. Some are used for hay or pasture. This soil generally is poorly suited to corn, soybeans, and small grain and moderately suited to grasses and legumes for hay and pasture. If cultivated crops are grown, further erosion is a hazard. The surface layer tends to seal and crust when worked. As a result, the rate of water infiltration is reduced and the runoff rate is increased. The increased runoff rate accelerates sheet and gully erosion. A system of conservation tillage that leaves crop residue on the surface, contour farming, and terraces help to prevent excessive soil loss. Tilth generally is poor in the surface layer. Returning crop residue to the soil or regularly adding other organic material improves fertility and tilth. More nitrogen and more intensive management are needed on this soil than on less eroded Otley soils.

A cover of pasture plants or hay is effective in controlling erosion. Proper stocking rates, pasture rotation, timely deferment of grazing, and applications of fertilizer help to keep the pasture and the soil in good condition.

The land capability classification is IVe.

281D2—Otley silty clay loam, 9 to 14 percent slopes, moderately eroded. This strongly sloping, moderately well drained soil is on convex side slopes in the loess-covered uplands. Areas range from 2 to 20 acres in size and are irregularly shaped.

Typically, the surface layer is very dark brown and black, friable silty clay loam about 10 inches thick. Because of plowing, it has some streaks and pockets of the brown subsoil material. The subsoil is firm silty clay loam about 40 inches thick. The upper part is brown, the next part is brown and mottled, and the lower part is mottled yellowish brown, light brownish gray, and strong brown. The substratum to a depth of about 60 inches is mottled light brownish gray, strong brown, and yellowish brown silt loam. In some places the subsoil is light brownish gray and has large accumulations of iron. In other places the surface layer is brown, firm silty clay loam and contains less organic matter because of severe erosion.

Included with this soil in mapping are small areas of Adair soils, which make up about 2 to 5 percent of the unit. These soils are redder than the Otley soil. Also, they have more clay in the subsoil. They are on the lower parts of the side slopes. The lower areas adjacent to these soils are subject to hillside seepage.

Permeability is moderate in the Otley soil, and runoff is rapid. Available water capacity is high. The content of organic matter is about 1.5 to 2.5 percent in the surface layer. The subsoil typically is medium acid or strongly acid. It generally has a low supply of available phosphorus and a very low supply of available potassium.

Most areas are cultivated. Some are used for hay or pasture. This soil is moderately suited to corn, soybeans, and small grain and well suited to grasses and legumes for hay and pasture. If cultivated crops are grown, further erosion is a hazard. A system of conservation tillage that leaves crop residue on the surface during the winter, contour farming, and terraces help to prevent excessive soil loss. In places, however, contour farming or terracing is difficult because of short, irregular slopes. Tilth generally is fair in the surface layer. Returning crop residue to the soil or regularly adding other organic material improves fertility and tilth.

A cover of pasture plants or hay is effective in controlling erosion. Proper stocking rates, pasture rotation, and timely deferment of grazing help to keep the pasture and the soil in good condition.

The land capability classification is IIIe.

281D3—Otley silty clay loam, 9 to 14 percent slopes, severely eroded. This strongly sloping, moderately well drained soil is on the narrow tops and sides of loess-covered ridges in the uplands. Areas range from 5 to 20 acres in size and are irregularly shaped.

Typically, the surface layer is brown, firm silty clay loam about 8 inches thick. Very dark grayish brown and black streaks and pockets make up 10 to 15 percent of this layer. The subsoil is firm silty clay loam about 28 inches thick. The upper part is brown, the next part is brown and mottled, and the lower part is mottled yellowish brown, light brownish gray, and strong brown. The substratum to a depth of about 60 inches is mottled light brownish gray, strong brown, and yellowish brown silt loam. In places the subsoil is light brownish gray and has large accumulations of iron.

Included with this soil in mapping are small areas of Adair soils, which make up about 2 to 5 percent of the

unit. These soils are redder than the Otley soil. Also, they have more clay in the subsoil. They are on the lower parts of the side slopes. The lower areas adjacent to these soils are subject to hillside seepage.

Permeability is moderate in the Otley soil, and runoff is rapid. Available water capacity is high. The content of organic matter is about 0.5 to 1.0 percent in the surface layer. The subsoil typically is medium acid or strongly acid. It generally has a low supply of available phosphorus and a very low supply of available potassium.

Most areas are cultivated. Some are used for hay or pasture. This soil is poorly suited to corn, soybeans, and small grain. If cultivated crops are grown, further erosion is a severe hazard. The surface layer tends to seal and crust when worked. As a result, the rate of water infiltration is reduced and the runoff rate is increased. The increased runoff rate accelerates sheet and gully erosion. Row crops can be grown in some years if erosion is controlled. A system of conservation tillage that leaves crop residue on the surface helps to prevent excessive soil loss. Grassed waterways help to prevent gullying. In most areas contour farming and terracing are practical, but they are not so practical in undulating areas where slopes are short.

Tilth generally is poor in the surface layer. Surface crusting is a problem. It adversely affects seedling emergence. Returning crop residue to the soil or regularly adding other organic material improves fertility, helps to prevent surface crusting, and increases the rate of water infiltration. More nitrogen and more intensive management are needed on this soil than on less eroded Otley soils.

This soil is moderately suited to grasses and legumes for hay and pasture. A cover of pasture plants or hay is effective in controlling erosion. Permanent pastures can be improved by renovating and reseeding. If they are improved, the content of organic matter slowly increases. Overgrazing or grazing when the soil is wet causes surface compaction and poor tilth and increases the runoff rate. Proper stocking rates, pasture rotation, and timely deferment of grazing help to keep the pasture and the soil in good condition.

The land capability classification is IVe.

293E2—Fayette-Lamont-Chelsea complex, 14 to 25 percent slopes, moderately eroded. These moderately steep and steep, well drained and excessively drained soils are on upland side slopes. Areas range from 5 to 30 acres in size and are irregularly shaped. They are about 40 percent Fayette soil, 30 percent Lamont soil, and 20 percent Chelsea soil. The three soils occur as areas so intricately mixed or so small that mapping them separately is impractical.

Typically, the surface layer of the Fayette soil is dark grayish brown and brown, friable silt loam about 8 inches thick. Because of plowing, it has some streaks and pockets of yellowish brown silty clay loam subsoil material. The subsoil is yellowish brown, friable silty clay loam about 40 inches thick. The substratum to a depth of about 60 inches is mottled yellowish brown, dark yellowish brown, and grayish brown silt loam.

Typically, the surface layer of the Lamont soil is very dark grayish brown, friable fine sandy loam about 3 inches thick. The subsurface layer is dark grayish brown, friable fine sandy loam about 4 inches thick. The subsoil extends to a depth of about 60 inches. The upper part is brown and strong brown, friable fine sandy loam, and the lower part is strong brown, very friable loamy fine sand. Bands of strong brown sandy loam are between depths of 30 and 60 inches.

Typically, the surface layer of the Chelsea soil is brown, very friable loamy fine sand about 7 inches thick. The subsurface layer to a depth of about 60 inches is loose fine sand. The upper part is brown and yellowish brown, the next part is light yellowish brown, and the lower part is brownish yellow and light yellowish brown. Bands of dark brown and strong brown loamy sand are between depths of 28 and 60 inches.

Included with these soils in mapping are small areas of Lindley and Keswick soils. Lindley soils formed in glacial till, and Keswick soils formed in a red, clayey paleosol over glacial till. Hillside seepage can occur in areas above the Keswick soils. Included soils make up less than 10 percent of the unit.

Permeability is moderate in the Fayette soil and rapid in the Chelsea soil. It is moderately rapid in the upper part of the Lamont soil and rapid in the lower part. Runoff is rapid on all three soils. Available water capacity is high in the Fayette soil, moderate in the Lamont soil, and low in the Chelsea soil. The content of organic matter is less than 0.5 percent in the surface layer of all three soils. Reaction typically is strongly acid to neutral in the surface layer of the Fayette and Lamont soils and slightly acid in the surface layer of the Chelsea soil. The subsoil of the Fayette and Lamont soils and the subsurface layer of the Chelsea soil typically are strongly acid. The supply of available phosphorus is high in the subsoil of the Fayette soil and low in the subsoil of the Lamont soil. It is very low in the subsurface layer of the Chelsea soil. The supply of available potassium is very low in the subsoil of the Fayette and Lamont soils and low in the subsurface layer of the Chelsea soil.

Most areas are used for pasture or hay. Some support native hardwoods. A few are cultivated. These soils are not suited to cultivated crops because they are low in fertility, droughty, and too steep. If the soils are used for cultivated crops, water erosion is a severe hazard. Wind erosion also is a hazard on the Lamont and Chelsea soils. Tilth is fair in the Clinton and Lamont soils and poor in the Chelsea soil.

A cover of pasture plants or hay is effective in controlling erosion. Overgrazing or grazing when the Fayette soil is too wet, however, causes surface

compaction and poor tilth, increases the runoff rate, and reduces forage production. Proper stocking rates, pasture rotation, and timely deferment of grazing, especially during wet periods, help to keep the pasture and the soil in good condition.

These soils are moderately suited to trees. Carefully selecting sites for logging trails and roads and laying out the trails or roads on the contour help to control erosion. Operating equipment can be hazardous because of the slope. Special equipment can be used. Caution is needed when equipment is operated. On the Lamont and Chelsea soils, seedlings do not survive and grow well because of the low available water capacity and the windthrow hazard is severe because of the loose consistency. Seedlings should be spaced close together on the Lamont and Chelsea soils. Supplemental water may be needed. Thinning the stand helps to provide adequate growing space for the surviving trees. Woodlots that are used for grazing are subject to compaction and erosion. Grazing also inhibits tree regeneration and causes root damage, which leads to heartrot and other diseases.

The land capability classification is Vle.

294C2—Ladoga-Billett complex, 5 to 9 percent slopes, moderately eroded. These moderately sloping, moderately well drained and well drained soils are on upland side slopes and ridges. Areas range from 5 to 30 acres in size and are irregularly shaped. They are about 60 percent Ladoga soil and 30 percent Billett soil. The two soils occur as areas so intricately mixed or so small that mapping them separately is impractical.

Typically, the surface layer of the Ladoga soil is very dark brown, friable silt loam about 8 inches thick. Because of plowing, it has some streaks and pockets of brown silty clay loam subsoil material. The subsoil is silty clay loam about 38 inches thick. The upper part is firm and is brown and yellowish brown. The lower part is friable, is yellowish brown, and has grayish brown mottles. The substratum to a depth of about 60 inches is yellowish brown and light brownish gray silty clay loam.

Typically, the surface layer of the Billett soil is very dark grayish brown and dark brown, friable sandy loam about 8 inches thick. Because of plowing, it has some streaks and pockets of yellowish brown subsoil material. The subsoil is about 45 inches thick. The upper part is brown and yellowish brown, friable sandy loam; the next part is yellowish brown, friable sandy loam; and the lower part is brownish yellow, very friable sand. The substratum to a depth of about 60 inches is brownish yellow loamy sand. Bands of strong brown loamy sand are between depths of 40 and 53 inches.

Included with these soils in mapping are areas of Rinda and Sparta soils. Rinda soils formed in a gray, clayey paleosol over glacial till. Hillside seepage can occur in areas above these soils. Sparta soils formed in sandy eolian material. They have a loamy sand surface layer and are more droughty than the Billett and Ladoga soils. Included soils make up less than 10 percent of the unit.

Permeability is moderately slow in the Ladoga soil. It is moderately rapid in the upper part of the Billett soil and rapid in the lower part. Runoff is medium on both soils. Available water capacity is high in the Ladoga soil and moderate in the Billett soil. The content of organic matter is about 0.5 to 1.5 percent in the surface layer of both soils. Reaction typically is slightly acid or neutral in the surface layer of the Ladoga soil and medium acid to neutral in the surface layer of the Billett soil. The subsoil of the Ladoga soil generally is strongly acid, and that of the Billett soil is medium acid. The supply of available phosphorus is medium in the subsoil of the Ladoga soil and very low in the subsoil of the Billett soil. The supply of available potassium is low in the subsoil of the Ladoga soil and very low in the subsoil of the Billett soil.

Most areas are cultivated. A few areas are used for pasture or are wooded. These soils are moderately suited to corn, soybeans, and small grain and well suited to grasses and legumes for hay and pasture. If row crops are grown, further erosion is a hazard. Also, wind erosion is a hazard on the Billett soil. A system of conservation tillage that leaves crop residue on the surface and contour farming conserve moisture and help to prevent excessive soil loss. Terraces are suitable in a few areas where the Ladoga soil is dominant. Because the topography is not uniform, however, terracing may be difficult. Tilth is fair in both soils. Returning crop residue to the soil or regularly adding other organic material improves fertility and tilth.

A cover of pasture plants or hay is effective in controlling erosion. Overgrazing or grazing when the Ladoga soil is too wet, however, causes surface compaction and poor tilth, increases the runoff rate, and reduces forage production. Proper stocking rates, pasture rotation, and timely deferment of grazing, especially during wet periods, help to keep the pasture and the soil in good condition.

These soils are moderately well suited to trees. Seedlings do not survive and grow well on the Billett soil because of the low available water capacity. They should be spaced close together on this soil. Supplemental water may be needed. Thinning the stand helps to provide adequate growing space for the surviving trees. Woodlots that are used for grazing are subject to compaction and erosion. Grazing also inhibits tree regeneration and causes root damage, which leads to heartrot and other diseases.

The land capability classification is IIIe.

294D2—Ladoga-Billett complex, 9 to 14 percent slopes, moderately eroded. These strongly sloping, moderately well drained and well drained soils are on upland side slopes. Areas range from 5 to 40 acres in size and are irregularly shaped. They are about 60

percent Ladoga soil and 30 percent Billett soil. The two soils occur as areas so intricately mixed or so small that mapping them separately is impractical.

Typically, the surface layer of the Ladoga soil is very dark brown, friable silt loam about 8 inches thick. Because of plowing, it has some streaks and pockets of brown silty clay loam subsoil material. The subsoil is silty clay loam about 36 inches thick. The upper part is firm and is brown and yellowish brown, and the lower part is friable, is yellowish brown, and has a few grayish brown mottles. The substratum to a depth of about 60 inches is yellowish brown and light brownish gray silty clay loam.

Typically, the surface layer of the Billett soil is very dark grayish brown and dark brown, friable sandy loam about 8 inches thick. Because of plowing, it has some streaks and pockets of yellowish brown subsoil material. The subsoil is about 43 inches thick. The upper part is brown and yellowish brown, friable sandy loam; the next part is yellowish brown, friable sandy loam; and the lower part is brownish yellow, very friable sand. The substratum to a depth of about 60 inches is brownish yellow loamy sand. Bands of strong brown loamy sand are between depths of 38 and 51 inches.

Included with these soils in mapping are areas of Rinda and Sparta soils. Rinda soils formed in a gray, clayey paleosol over glacial till. Hillside seepage can occur in areas above these soils. Sparta soils formed in sandy eolian material. They have a loamy sand surface layer and are more droughty than the Billett and Ladoga soils. Included soils make up less than 10 percent of the unit.

Permeability is moderately slow in the Ladoga soil. It is moderately rapid in the upper part of the Billett soil and rapid in the lower part. Runoff is rapid on both soils. Available water capacity is high in the Ladoga soil and moderate in the Billett soil. The content of organic matter is about 0.5 to 1.0 percent in the surface layer of both soils. Reaction typically is slightly acid or neutral in the surface layer of the Ladoga soil and is medium acid to neutral in the surface layer of the Billett soil. The subsoil of the Ladoga soil typically is strongly acid, and that of the Billett soil is medium acid. The subsoil of the Ladoga soil generally has a medium supply of available phosphorus and a low supply of available potassium. The subsoil of the Billett soil generally has a very low supply of available phosphorus and potassium.

Most areas are cultivated or are used for hay or pasture. Some are wooded. These soils are poorly suited to corn, soybeans, and small grain and well suited to grasses and legumes for hay and pasture. If row crops are grown, water erosion is a severe hazard. Also, wind erosion is a hazard on the Billett soil. A system of conservation tillage that leaves crop residue on the surface and contour farming conserve moisture and help to prevent excessive soil loss. Terraces are suitable in a few areas where the Ladoga soil is dominant. Because the topography is not uniform, however, terracing may be difficult. Tilth is fair in both soils. Returning crop residue to the soil or regularly adding other organic material improves fertility and tilth.

A cover of pasture plants or hay is effective in controlling erosion. Overgrazing or grazing when the Ladoga soil is too wet, however, causes surface compaction and poor tilth, increases the runoff rate, and reduces forage production. Proper stocking rates, pasture rotation, and timely deferment of grazing, especially during wet periods, help to keep the pasture and the soil in good condition.

These soils are moderately well suited to trees. Seedlings do not survive and grow well on the Billett soil because of the low available water capacity. They should be spaced close together on this soil. Supplemental water may be needed. Thinning the stand helps to provide adequate growing space for the surviving trees. Woodlots that are used for grazing are subject to compaction and erosion. Grazing also inhibits tree regeneration and causes root damage, which leads to heartrot and other diseases.

The land capability classification is IVe.

295C2—Clinton-Lamont-Chelsea complex, 5 to 9 percent slopes, moderately eroded. These moderately sloping soils are on upland side slopes and ridges. The Clinton soil is moderately well drained, the Lamont soil is well drained, and the Chelsea soil is excessively drained. Areas range from 5 to 30 acres in size and are irregularly shaped. They are about 40 percent Clinton soil, 30 percent Lamont soils, and 20 percent Chelsea soil. The three soils occur as areas so intricately mixed or so small that mapping them separately is impractical.

Typically, the surface layer of the Clinton soil is dark grayish brown and brown, friable silt loam about 8 inches thick. Because of plowing, it has some streaks and pockets of yellowish brown silty clay loam subsoil material. The subsoil to a depth of about 60 inches is yellowish brown silty clay loam. The upper part is firm, and the lower part is friable and is mottled with grayish brown.

Typically, the surface layer of the Lamont soil is very dark grayish brown, friable fine sandy loam about 4 inches thick. The subsurface layer is dark grayish brown, friable fine sandy loam about 6 inches thick. The subsoil extends to a depth of about 60 inches. The upper part is brown and strong brown, friable fine sandy loam, and the lower part is strong brown, very friable loamy fine sand. Bands of strong brown sandy loam are between depths of 38 and 60 inches.

Typically, the surface layer of the Chelsea soil is brown, very friable loamy fine sand about 7 inches thick. The subsurface layer to a depth of about 60 inches is loose fine sand. The upper part is brown and yellowish brown, the next part is light yellowish brown, and the lower part is brownish yellow and light yellowish brown.

Bands of dark brown and strong brown loamy sand are between depths of 36 and 60 inches.

Included with these soils in mapping are small areas of Lindley and Keswick soils. Lindley soils formed in glacial till, and Keswick soils formed in a red, clayey paleosol over glacial till. Hillside seepage can occur in areas above the Keswick soils. Included soils make up less than 10 percent of the unit.

Permeability is moderately slow in the Clinton soil and rapid in the Chelsea soil. It is moderately rapid in the upper part of the Lamont soil and rapid in the lower part. Runoff is medium on all three soils. Available water capacity is high in the Clinton soil, moderate in the Lamont soil, and low in the Chelsea soil. The content of organic matter is about 0.5 to 1.0 percent in the surface layer of the Clinton soil and is less than 0.5 percent in the surface layer of the Lamont and Chelsea soils. The surface layer typically is medium acid to neutral in the Clinton soil, strongly acid to neutral in the Lamont soil, and slightly acid in the Chelsea soil. The subsoil of the Clinton and Lamont soils and the subsurface layer of the Chelsea soil typically are strongly acid. The supply of available phosphorus generally is high in the subsoil of the Clinton soil, low in the subsoil of the Lamont soil, and very low in the subsurface layer of the Chelsea soil. The supply of available potassium is low in the subsoil of the Clinton soil and in the subsurface layer of the Chelsea soil. It is very low in the subsoil of the Lamont soil.

Most areas are cultivated. A few are used for pasture or are wooded. These soils are moderately suited to corn, soybeans, and small grain and well suited to grasses and legumes for hay and pasture. If row crops are grown, water erosion is a hazard. Wind erosion also is a hazard on the Lamont and Chelsea soils. A system of conservation tillage that leaves crop residue on the surface and contour farming conserve moisture and help to prevent excessive soil loss. Terraces are suitable in a few areas where the Clinton soil is dominant. Because the topography is not uniform, however, terracing may be difficult. Tilth is fair in the Clinton and Lamont soils and poor in the Chelsea soil. Returning crop residue to the soil or regularly adding other organic material improves fertility and tilth.

A cover of pasture plants or hay is effective in controlling erosion. Overgrazing or grazing when the Clinton soil is too wet, however, causes surface compaction and poor tilth, increases the runoff rate, and reduces forage production. Proper stocking rates, pasture rotation, and timely deferment of grazing, especially during wet periods, help to keep the pasture and the soil in good condition.

These soils are moderately well suited to trees. Seedlings do not survive and grow well on the Lamont and Chelsea soils because of the low available water capacity. As a result, they should be spaced close together. Supplemental water may be needed. Thinning the stand helps to provide adequate growing space for the surviving trees. Woodlots that are used for grazing are subject to compaction and erosion. Grazing also inhibits tree regeneration and causes root damage, which leads to heartrot and other diseases.

The land capability classification is IIIe.

295D2—Clinton-Lamont-Chelsea complex, 9 to 14 percent slopes, moderately eroded. These strongly sloping soils are on upland side slopes. The Clinton soil is moderately well drained, the Lamont soil is well drained, and the Chelsea soil is excessively drained. Areas range from 5 to 40 acres in size and are irregularly shaped. They are about 40 percent Clinton soil, 30 percent Lamont soil, and 20 percent Chelsea soil. The three soils occur as areas so intricately mixed or so small that mapping them separately is impractical.

Typically, the surface layer of the Clinton soil is dark grayish brown and brown, friable silt loam about 8 inches thick. Because of plowing, it has some streaks and pockets of yellowish brown silty clay loam subsoil material. The subsoil is yellowish brown silty clay loam about 48 inches thick. The upper part is firm, and the lower part is friable and has grayish brown mottles. The substratum to a depth of about 60 inches is mottled yellowish brown and grayish brown silty clay loam. In places the surface layer is mixed brown and yellowish brown silty clay loam and contains less organic matter because of severe erosion.

Typically, the surface layer of the Lamont soil is very dark grayish brown, friable fine sandy loam about 4 inches thick. The subsurface layer is dark grayish brown, friable fine sandy loam about 5 inches thick. The subsoil extends to a depth of about 60 inches. The upper part is brown and strong brown, friable fine sandy loam, and the lower part is strong brown, very friable loamy fine sand. Bands of strong brown sandy loam are between depths of 35 and 60 inches.

Typically, the surface layer of the Chelsea soil is brown, very friable loamy fine sand about 7 inches thick. The subsurface layer to a depth of about 60 inches is loose fine sand. The upper part is brown and yellowish brown, the next part is light yellowish brown, and the lower part is brownish yellow and light yellowish brown. Bands of dark brown and strong brown loamy sand are between depths of 28 and 60 inches.

Included with these soils in mapping are small areas of Lindley and Keswick soils. Lindley soils formed in glacial till, and Keswick soils formed in a red, clayey paleosol over glacial till. Hillside seepage can occur in areas above the Keswick soils. Included soils make up less than 10 percent of the unit.

Permeability is moderately slow in the Clinton soil and rapid in the Chelsea soil. It is moderately rapid in the upper part of the Lamont soil and rapid in the lower part. Runoff is rapid on all three soils. Available water capacity is high in the Clinton soil, moderate in the

Lamont soil, and low in the Chelsea soil. The content of organic matter is less than 0.5 percent in the surface layer of all three soils. The surface layer typically is medium acid to neutral in the Clinton soil, strongly acid to neutral in the Lamont soil, and slightly acid in the Chelsea soil. The subsoil of the Clinton and Lamont soils and the subsurface layer of the Chelsea soil typically are strongly acid. The supply of available phosphorus generally is high in the subsoil of the Clinton soil, low in the subsoil of the Lamont soil, and very low in the subsurface layer of the Chelsea soil. The supply of available potassium is low in the subsoil of the Clinton soil and in the subsurface layer of the Chelsea soil. It is very low in the subsoil of the Lamont soil.

Most areas are cultivated or are used for hay or pasture. A few areas support trees. These soils are poorly suited to corn, soybeans, and small grain and well suited to grasses and legumes for hay and pasture. If row crops are grown, water erosion is a severe hazard. Wind erosion also is a hazard on the Lamont and Chelsea soils. A system of conservation tillage that leaves crop residue on the surface and contour farming conserve moisture and help to prevent excessive soil loss. Terraces are suitable in a few areas where the Clinton soil is dominant. Because the topography is not uniform, however, terracing may be difficult. Tilth is fair in the Clinton and Lamont soils and poor in the sandy Chelsea soil. Returning crop residue to the soil or regularly adding other organic material improves fertility and tilth.

A cover of pasture plants or hay is effective in controlling erosion. Overgrazing or grazing when the Clinton soil is too wet, however, causes surface compaction and poor tilth, increases the runoff rate, and reduces forage production. Proper stocking rates, pasture rotation, and timely deferment of grazing, especially during wet periods, help to keep the pasture and the soil in good condition.

These soils are moderately well suited to trees. Seedlings do not survive and grow well on the Lamont and Chelsea soils because of the low available water capacity. As a result, they should be spaced close together. Supplemental water may be needed. Thinning the stand helps to provide adequate growing space for the surviving trees. Woodlots that are used for grazing are subject to compaction and erosion. Grazing also inhibits tree regeneration and causes root damage, which leads to heartrot and other diseases.

The land capability classification is IVe.

295D3—Clinton-Lamont-Chelsea complex, 9 to 14 percent slopes, severely eroded. These strongly sloping soils are on upland side slopes. The Clinton soil is moderately well drained, the Lamont soil is well drained, and the Chelsea soil is excessively well drained. Areas range from 5 to 40 acres in size and are irregularly shaped. They are about 40 percent Clinton soil, 30 percent Lamont soil, and 20 percent Chelsea soil. The three soils occur as areas so intricately mixed or so small that mapping them separately is impractical.

Typically, the surface layer of the Clinton soil is brown and yellowish brown, firm silty clay loam about 7 inches thick. Streaks and pockets of dark grayish brown silt loam make up 10 to 15 percent of this layer. The subsoil is yellowish brown silty clay loam about 34 inches thick. The upper part is firm, and the lower part is friable and has grayish brown mottles. The substratum to a depth of about 60 inches is mottled grayish brown and yellowish brown silt loam.

Typically, the surface layer of the Lamont soil is brown and strong brown, friable fine sandy loam about 7 inches thick. Very dark grayish brown streaks and pockets make up 10 to 15 percent of this layer. The subsoil extends to a depth of about 60 inches. The upper part is brown and strong brown, friable fine sandy loam, and the lower part is strong brown, very friable loamy fine sand. Bands of strong brown sandy loam are between depths of 32 and 60 inches.

Typically, the surface layer of the Chelsea soil is yellowish brown, loose fine sand about 7 inches thick. Streaks and pockets of brown loamy fine sand make up 10 to 15 percent of this layer. The subsurface layer to a depth of about 60 inches is loose fine sand. The upper part is brown and yellowish brown, the next part is light yellowish brown, and the lower part is brownish yellow and light yellowish brown. Bands of dark brown and strong brown loamy sand are between depths of 20 and 60 inches.

Included with these soils in mapping are small areas of Lindley and Keswick soils. Lindley soils formed in glacial till, and Keswick soils formed in a red, clayey paleosol over glacial till. Hillside seepage can occur in areas above the Keswick soils. Included soils make up less than 10 percent of the unit.

Permeability is moderately slow in the Clinton soil and rapid in the Chelsea soil. It is moderately rapid in the upper part of the Lamont soil and rapid in the lower part. Runoff is rapid on the Clinton and Lamont soils and medium on the Chelsea soil. Available water capacity is high in the Clinton soil, moderate in the Lamont soil, and low in the Chelsea soil. The content of organic matter is less than 0.5 percent in the surface layer of all three soils. The surface layer typically is strongly acid to medium acid in the Clinton soil, strongly acid or medium acid in the Lamont soil, and strongly acid in the Chelsea soil. The supply of available phosphorus generally is high in the subsoil of the Clinton soil, low in the subsoil of the Lamont soil, and very low in the subsurface layer of the Chelsea soil. The supply of available phosphorus is low in the subsoil of the Clinton soil and in the subsurface layer of the Chelsea soil. It is very low in the subsoil of the Lamont soil.

Most areas are cultivated or are used for hay or pasture. Very few areas support trees. These soils are

poorly suited to corn, soybeans, and small grain. They are better suited to grasses and legumes for hay and pasture. If row crops are grown, water erosion is a severe hazard. Wind erosion also is a hazard on the Lamont and Chelsea soils. The surface layer of the Clinton soil tends to seal and crust when worked. As a result, the rate of water infiltration is reduced and the runoff rate is increased. The increased runoff rate accelerates sheet and gully erosion. A system of conservation tillage that leaves crop residue on the surface and contour farming conserve moisture and help to prevent excessive soil loss. Terraces are suitable in a few areas where the Clinton soil is dominant. Because the topography is not uniform, however, terracing may be difficult.

Tilth generally is poor in these soils because of the severe erosion and the resulting lack of organic matter and increased clay content in the surface layer of the Clinton soil. Returning crop residue to the soil or regularly adding other organic material improves fertility and tilth. More nitrogen and more intensive management are needed on these soils than on less eroded Clinton, Lamont, and Chelsea soils.

A cover of pasture plants or hay is effective in controlling erosion. Overgrazing or grazing when the Clinton soil is too wet, however, causes surface compaction and poor tilth, increases the runoff rate, and reduces forage production. Proper stocking rates, pasture rotation, and timely deferment of grazing, especially during wet periods, help to keep the pasture and the soil in good condition.

These soils are moderately suited to trees. Seedlings do not survive and grow well. As a result, they should be spaced close together. Supplemental water may be needed in areas of the Lamont and Chelsea soils. Thinning the stand helps to provide adequate growing space for the surviving trees. Woodlots that are used for grazing are subject to compaction and erosion. Grazing also inhibits tree regeneration and causes root damage, which leads to heartrot and other diseases.

The land capability classification is IVe.

422—Amana silt loam, 0 to 2 percent slopes. This nearly level, somewhat poorly drained soil is on bottom land along the major streams and their tributaries. It is occasionally flooded. Areas range from 3 to 25 acres in size and are irregularly shaped.

Typically, the surface layer is black, friable silt loam about 10 inches thick. The subsurface layer is very dark gray, friable silt loam about 6 inches thick. The subsoil is friable silt loam about 32 inches thick. The upper part is dark grayish brown and grayish brown, and the lower part is grayish brown and mottled. The substratum to a depth of about 60 inches is grayish brown and dark grayish brown silt loam.

Included with this soil in mapping are small areas of the poorly drained Coppock soils. These soils have a thick, light colored subsurface layer that is low in fertility. They typically are in the slightly lower, less stable landscape positions below the Amana soil. They make up less than 10 percent of the unit.

Permeability is moderate in the Amana soil, and runoff is slow. Available water capacity is high. This soil has a seasonal high water table. The content of organic matter is about 3.5 to 4.5 percent in the surface layer. The subsoil typically is strongly acid. It generally has a medium supply of available phosphorus and a very low supply of available potassium.

Most areas are cultivated. Some are used for hay and pasture or are wooded. This soil is well suited to corn, soybeans, and small grain but is subject to periodic flooding. Protection against overflow is needed in some areas. Fieldwork may be delayed in spring, when the water table generally is high. Subsurface drains generally function satisfactorily, but a surface drainage system is needed in some areas. Good tilth generally can be easily maintained. Returning crop residue to the soil or regularly adding other organic material helps to maintain fertility and good tilth.

If this soil is used for pasture or hay, overgrazing or grazing when the soil is too wet causes surface compaction and results in poorer tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and the soil in good condition.

This soil is moderately suited to trees. The occasional flooding can damage new stands of trees and planted seedlings. Woodlots that are used for grazing are subject to compaction. Grazing also inhibits tree regeneration and causes root damage, which leads to heartrot and other diseases.

The land capability classification is IIw.

424D—Lindley-Keswick complex, 9 to 14 percent slopes. These strongly sloping soils are on upland side slopes. The well drained Lindley soil is on the lower part of the side slopes, and the somewhat poorly drained Keswick soil is on the upper part. Areas range from 5 to 40 acres in size and are irregularly shaped. They are about 55 percent Lindley soil and 35 percent Keswick soil. The two soils occur as areas so intricately mixed or so small that mapping them separately is impractical.

Typically, the surface layer of the Lindley soil is very dark grayish brown, friable loam about 4 inches thick. The subsurface layer is dark grayish brown, friable loam about 3 inches thick. The subsoil is firm clay loam about 44 inches thick. The upper part is strong brown, and the lower part is yellowish brown and strong brown. The substratum to a depth of about 60 inches is yellowish brown clay loam mottled with strong brown.

Typically, the surface layer of the Keswick soil is very dark grayish brown, friable silt loam about 3 inches thick. The subsurface layer is dark grayish brown, friable silt loam about 3 inches thick. The subsoil extends to a

depth of about 60 inches. The upper part is brown, very firm clay mottled with grayish brown, dark reddish brown, and dusky red; the next part is mottled dark reddish brown, grayish brown, and dark yellowish brown, very firm clay; and the lower part is grayish brown, gray, and light gray, very firm and firm clay loam mottled with strong brown.

Included with these soils in mapping are small areas of Clinton soils. These included soils are silty throughout. They are higher on the landscape than the Lindley and Keswick soils. They make up less than 10 percent of the unit.

Permeability is moderately slow or slow in the Lindley and Keswick soils, and runoff is rapid. Available water capacity is high. The Keswick soil has a seasonal high water table. The content of organic matter is about 1 to 2 percent in the surface layer of both soils. The shrink-swell potential is high in the Keswick soil. The surface layer of both soils typically is slightly acid, and the subsoil is strongly acid or medium acid. The subsoil of the Lindley soil generally has a low supply of available phosphorus and a very low supply of available potassium. The subsoil of the Keswick soil generally has a very low supply of available phosphorus and potassium.

Most areas are used for trees. Some are used for hay and pasture, and a few are cultivated. In most areas these soils are managed along with the adjacent soils. They are poorly suited to corn, soybeans, and small grain. They are moderately suited to grasses and legumes for hay and pasture. If cultivated crops are grown, erosion is a hazard. It can be controlled, however, by contour farming, terraces, a system of conservation tillage that leaves crop residue on the surface, and crop rotations that include meadow crops. Terrace cuts should be shallow enough to prevent exposure of the clayey subsoil.

Good tilth generally can be easily maintained in these soils. Returning crop residue to the soil or regularly adding other organic material helps to maintain good tilth and fertility, helps to prevent surface crusting, and increases the rate of water infiltration. Because the soils are seepy when wet, measures that help to prevent compaction of the surface layer are needed. Also, the soils should not be worked during wet periods.

A cover of pasture plants or hay is effective in controlling erosion. Overgrazing, however, causes surface compaction and poor tilth, increases the rate of runoff, and reduces forage production. Proper stocking rates, pasture rotation, and timely deferment of grazing, especially during wet periods, help to keep the pasture and the soils in good condition.

These soils are moderately well suited to trees. Seedlings do not survive well, especially on the Keswick soil. As a result, they should be spaced close together. Thinning the stand helps to provide adequate growing space for the surviving trees. Windthrow is a hazard on the Keswick soil because of a shallow rooting depth. Woodlots that are used for grazing are subject to compaction and erosion. Grazing also inhibits tree regeneration and causes root damage, which leads to heartrot and other diseases.

The land capability classification is IVe.

424D2—Lindley-Keswick complex, 9 to 14 percent slopes, moderately eroded. These strongly sloping soils are on upland side slopes. The well drained Lindley soil is on the lower part of the side slopes, and the somewhat poorly drained Keswick soil is on the upper part. Areas range from 5 to 80 acres in size and are irregularly shaped. They are about 55 percent Lindley soil and 35 percent Keswick soil. The two soils occur as areas so intricately mixed or so small that mapping them separately is impractical.

Typically, the surface layer of the Lindley soil is dark grayish brown, friable loam about 6 inches thick. Because of plowing, it has some streaks and pockets of strong brown clay loam subsoil material. The subsoil is firm clay loam about 43 inches thick. The upper part is strong brown, and the lower part is yellowish brown and strong brown. The substratum to a depth of about 60 inches is yellowish brown clay loam mottled with strong brown. In places the surface layer is strong brown, firm clay loam because of severe erosion.

Typically, the surface layer of the Keswick soil is very dark grayish brown and dark grayish brown, friable silt loam about 5 inches thick. Because of plowing, it has some streaks and pockets of brown silty clay loam subsoil material. The subsoil extends to a depth of about 60 inches. In sequence downward, it is brown, friable silty clay loam; mottled brown, dark reddish brown, and grayish brown, very firm clay; mottled gray, grayish brown, and dark reddish brown, very firm clay and clay loam; and light gray, firm clay loam mottled with strong brown. In places the surface layer is brown and dark reddish brown, firm clay loam because of severe erosion.

Included with these soils in mapping are small areas of Clinton soils. These included soils are silty throughout. They are higher on the landscape than the Lindley and Keswick soils. They make up less than 10 percent of the unit.

Permeability is moderately slow or slow in the Lindley and Keswick soils, and runoff is rapid. Available water capacity is high. The Keswick soil has a seasonal high water table. The content of organic matter is less than 0.5 percent to about 1.0 percent in the surface layer of both soils. The shrink-swell potential is high in the Keswick soil. The surface layer of both soils typically is slightly acid, and the subsoil is strongly acid or medium acid. The subsoil of the Lindley soil generally has a low supply of available phosphorus and a very low supply of available potassium. The subsoil of the Keswick soil generally has a very low supply of available phosphorus and potassium.

Most areas are cultivated or are used for hay and pasture. Several areas support trees. In most areas these soils are managed along with the adjacent soils. They are poorly suited to corn, soybeans, and small grain and moderately suited to grasses and legumes for hay and pasture. If cultivated crops are grown, erosion is a hazard. It can be controlled, however, by contour farming, terraces, a system of conservation tillage that leaves crop residue on the surface, and crop rotations that include meadow crops. Terrace cuts should be shallow enough to prevent exposure of the clayey subsoil.

Tilth generally is poor or fair in these soils. Returning crop residue to the soil or regularly adding other organic material improves tilth and fertility, helps to prevent surface crusting, and increases the rate of water infiltration. Because the soils are seepy when wet, measures that help to prevent compaction are needed. Also, the soils should not be worked during wet periods.

A cover of pasture plants or hay is effective in controlling erosion. Overgrazing, however, causes surface compaction and poor tilth, increases the rate of runoff, and reduces forage production. Proper stocking rates, pasture rotation, and timely deferment of grazing, especially during wet periods, help to keep the pasture and the soils in good condition.

These soils are moderately well suited to trees. Seedlings do not survive well, especially on the Keswick soil. As a result, they should be spaced close together. Thinning the stand helps to provide adequate growing space for the surviving trees. Windthrow is a hazard on the Keswick soil because of a shallow rooting depth. Woodlots that are used for grazing are subject to compaction and erosion. Grazing also inhibits tree regeneration and causes root damage, which leads to heartrot and other diseases.

The land capability classification is IVe.

424D3—Lindley-Keswick clay loams, 9 to 14 percent slopes, severely eroded. These strongly sloping soils are on upland side slopes. The well drained Lindley soil is on the lower part of the side slopes, and the somewhat poorly drained Keswick soil is on the upper part. Areas range from 5 to 30 acres in size and are irregularly shaped. They are about 55 percent Lindley soil and 35 percent Keswick soil. The two soils occur as areas so intricately mixed or so small that mapping them separately is impractical.

Typically, the surface layer of the Lindley soil is strong brown, firm clay loam about 4 inches thick. Grayish brown streaks and pockets make up about 10 to 15 percent of this layer. The subsoil is firm clay loam about 36 inches thick. The upper part is strong brown, and the lower part is yellowish brown and strong brown. The substratum to a depth of about 60 inches is yellowish brown clay loam mottled with strong brown.

Typically, the surface layer of the Keswick soil is brown and dark reddish brown, firm clay loam about 4 inches thick. Dark grayish brown streaks and pockets make up about 10 to 15 percent of this layer. The subsoil extends to a depth of about 60 inches. The upper part is brown, very firm clay mottled with grayish brown, dark reddish brown, and dusky red; the next part is mottled dark reddish brown, grayish brown, and dark yellowish brown, very firm clay; and the lower part is grayish brown, gray, and light gray, very firm and firm clay loam mottled with strong brown.

Included with these soils in mapping are small areas of Clinton soils. These included soils are silty throughout. They are higher on the landscape than the Lindley and Keswick soils. They make up less than 10 percent of the unit.

Permeability is moderately slow or slow in the Lindley and Keswick soils, and runoff is rapid. Available water capacity is high. The Keswick soil has a seasonal high water table. The content of organic matter is less than 0.5 percent in the surface layer of both soils. The shrink-swell potential is high in the Keswick soil. Reaction typically is medium acid or strongly acid in the surface layer and subsoil of both soils. The subsoil of the Lindley soil generally has a low supply of available phosphorus and a very low supply of available potassium. The subsoil of the Keswick soil generally has a very low supply of available phosphorus and potassium.

Some areas are cultivated. Almost all areas have been cultivated in the past. Many are now used for hay and pasture. In most areas these soils are managed along with the adjacent areas. Because of the slope and a severe erosion hazard, they are generally unsuited to cultivated crops. They are poorly suited to grasses and legumes for hay and pasture. The surface layer tends to seal and crust when worked. As a result, the runoff rate is increased. Tilth generally is poor in the surface layer. These soils generally are seepy when wet. More nitrogen and more intensive management are needed on these soils than on less eroded Lindley and Keswick soils.

A cover of pasture plants or hay is effective in controlling erosion. Overgrazing, however, causes surface compaction and poor tilth, increases the rate of runoff, and reduces forage production. Proper stocking rates, pasture rotation, and timely deferment of grazing, especially during wet periods, help to keep the pasture and the soils in good condition.

These soils are moderately suited to trees. Seedlings do not survive and grow well, especially on the Keswick soil. As a result, they should be spaced close together. Thinning the stand helps to provide adequate growing space for the surviving trees. Because of the clayey surface layer, operating equipment may be difficult during wet periods. Windthrow is a hazard on the Keswick soil because of a shallow rooting depth. Woodlots that are used for grazing are subject to compaction and erosion.

Grazing also inhibits tree regeneration and causes root damage, which leads to heartrot and other diseases.

The land capability classification is VIe.

424E2—Lindley-Keswick complex, 14 to 18 percent slopes, moderately eroded. These moderately steep soils are on upland side slopes. The well drained Lindley soil is on the lower part of the side slopes, and the somewhat poorly drained Keswick soil is on the upper part. Areas range from 5 to 40 acres in size and are irregularly shaped. They are about 55 percent Lindley soil and 35 percent Keswick soil. The two soils occur as areas so intricately mixed or so small that mapping them separately is impractical.

Typically, the surface layer of the Lindley soil is dark grayish brown, friable loam about 6 inches thick. Because of plowing, it has some streaks and pockets of strong brown clay loam subsoil material. The subsoil is firm clay loam about 40 inches thick. The upper part is strong brown, and the lower part is yellowish brown and strong brown. The substratum to a depth of about 60 inches is yellowish brown clay loam mottled with strong brown. In places the surface layer is strong brown, firm clay loam because of severe erosion.

Typically, the surface layer of the Keswick soil is very dark grayish brown and dark grayish brown, friable silt loam about 5 inches thick. Because of plowing, it has some streaks and pockets of brown silty clay loam subsoil material. The subsoil extends to a depth of about 60 inches. The upper part is brown, friable silty clay loam; the next part is mottled brown, dark reddish brown, gray, and grayish brown, very firm clay and clay loam; and the lower part is light gray, firm clay loam mottled with strong brown. In some places the surface layer is brown and dark reddish brown, firm clay loam because of severe erosion. In other places the subsoil is gray, contains more clay, and is more slowly permeable.

Included with these soils in mapping are small areas of Clinton soils. These included soils are silty throughout. They are higher on the landscape than the Lindley and Keswick soils. They make up less than 10 percent of the unit.

Permeability is moderately slow or slow in the Lindley and Keswick soils, and runoff is rapid. Available water capacity is high. The Keswick soil has a seasonal high water table. The content of organic matter is less than 0.5 percent in the surface layer of both soils. The shrink-swell potential is high in the Keswick soil. The surface layer of both soils typically is slightly acid, and the subsoil is medium acid or strongly acid. The subsoil of the Lindley soil generally has a low supply of available phosphorus and a very low supply of available potassium. The subsoil of the Keswick soil generally has a very low supply of available phosphorus and potassium.

Most areas are used for hay or pasture. Some are cultivated. A few support native hardwoods. Because of the slope and a severe hazard of erosion, these soils generally are unsuited to cultivated crops. They are moderately suited to grasses and legumes for hay and pasture. Tilth generally is fair in the surface layer. A cover of pasture plants or hay is effective in controlling erosion. Overgrazing, however, causes surface compaction and poor tilth, increases the rate of runoff, and reduces forage production. Proper stocking rates, pasture rotation, and timely deferment of grazing, especially during wet periods, help to keep the pasture and the soils in good condition.

These soils are suited to trees. Erosion, the equipment limitation, and seedling mortality are the main management concerns. Carefully selecting sites for logging trails or roads and laying out the trails or roads on the contour help to control erosion. Because of the slope, special logging equipment is needed. Also, caution is needed when this equipment is operated. Because they do not survive and grow well, seedlings should be planted at close intervals. Thinning the stand helps to provide adequate growing space for the surviving trees. Windthrow is a hazard on the Keswick soil because of a shallow rooting depth. Woodlots that are used for grazing are subject to compaction and erosion. Grazing also inhibits tree regeneration and causes root damage, which leads to heartrot and other diseases.

The land capability classification is VIe.

425D2—Keswick silt loam, 9 to 14 percent slopes, moderately eroded. This strongly sloping, somewhat poorly drained soil is on short, convex side slopes and nose slopes in the uplands. Areas range from 3 to 25 acres in size and are irregularly shaped.

Typically, the surface layer is very dark grayish brown and dark grayish brown, friable silt loam about 5 inches thick. Because of plowing, it has some streaks and pockets of brown silty clay loam subsoil material. The subsoil extends to a depth of about 60 inches. The upper part is brown, friable silty clay loam; the next part is mottled brown, dark reddish brown, gray, and grayish brown, very firm clay and clay loam; and the lower part is light gray, firm clay loam mottled with strong brown. In places the surface layer is brown and dark reddish brown, firm clay loam because of severe erosion.

Included with this soil in mapping are areas of the well drained Lindley soils on the lower slopes. These soils contain less clay in the subsoil than the Keswick soil. They make up about 5 to 10 percent of the unit.

Permeability is slow in the Keswick soil, and runoff is rapid. Available water capacity is moderate. This soil has a seasonal high water table. The content of organic matter is about 0.5 to 1.0 percent in the surface layer. The shrink-swell potential is high. The subsoil typically is medium acid or strongly acid. It generally has a very low supply of available phosphorus and potassium.

Most areas are cultivated or are used for hay and pasture. This soil is poorly suited to corn, soybeans, and small grain and moderately suited to grasses and legumes for hay and pasture. If cultivated crops are grown, further erosion is a severe hazard. A system of conservation tillage that leaves crop residue on the surface, contour farming, and terraces help to prevent excessive soil loss. If terraces are constructed, cuts should be shallow enough to avoid exposure of the clayey subsoil. Tilth generally is fair or poor in the surface layer. Returning crop residue to the soil or regularly adding other organic material improves fertility and tilth. Because this soil is seepy when wet, measures that help to prevent compaction of the surface layer are needed. Also, the soil should not be worked during wet periods.

A cover of pasture plants or hay is effective in controlling erosion. Proper stocking rates, pasture rotation, and timely deferment of grazing help to keep the pasture and the soil in good condition.

This soil is moderately suited to trees. The main management concern is the windthrow hazard, which is caused by a shallow rooting depth. Seedlings do not survive and grow well. As a result, they should be spaced close together. Thinning the stand helps to provide adequate growing space for the surviving trees. Woodlots that are used for grazing are subject to compaction and erosion. Grazing also inhibits tree regeneration and causes root damage, which leads to heartrot and other diseases.

The land capability classification is IVe.

428B—Ely silty clay loam, 2 to 5 percent slopes. This gently sloping, somewhat poorly drained soil is in upland drainageways and on foot slopes. It is subject to runoff from the adjacent upland slopes. Areas range from 5 to 40 acres in size and are irregularly shaped.

Typically, the surface layer is black and very dark brown, friable silty clay loam about 8 inches thick. The subsurface layer is black, very dark brown, and dark brown, friable silty clay loam about 18 inches thick. The subsoil to a depth of about 60 inches is friable silty clay loam. The upper part is mottled very dark grayish brown, dark grayish brown, and yellowish brown; the next part is mottled yellowish brown, brown, and grayish brown; and the lower part is mottled yellowish brown and grayish brown. In some places the soil has a brown subsoil and is better drained. In other places it has a silt loam surface layer.

Permeability is moderate, and runoff is medium. Available water capacity is high. This soil has a seasonal high water table. The content of organic matter typically is about 5 to 6 percent in the surface layer. The subsurface layer and subsoil typically are neutral or slightly acid. The subsoil generally has a low supply of available phosphorus and potassium.

Most areas are cultivated. Some are used for hay and pasture. This soil is well suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. Seepage from soils upslope often keeps this soil wet. A subsurface drainage system can reduce the wetness if suitable outlets are available. A system of conservation tillage that leaves crop residue on the surface helps to prevent excessive soil loss. Good tilth generally can be easily maintained. Returning crop residue to the soil or regularly adding other organic material helps to maintain tilth, improves fertility, and increases the rate of water infiltration.

A cover of pasture plants or hay is effective in controlling erosion. Overgrazing or grazing when the soil is wet, however, causes surface compaction and deterioration of tilth and thus reduces the extent of the protective plant cover.

The land capability classification is IIe.

430—Ackmore silt loam, 0 to 2 percent slopes. This nearly level, somewhat poorly drained soil is on bottom land. It is occasionally flooded. Areas range from 5 to 50 acres in size and are irregularly shaped.

Typically, the surface layer is dark grayish brown, friable silt loam about 8 inches thick. The substratum is stratified dark grayish brown, very dark gray, brown, and very dark grayish brown, friable silt loam about 18 inches thick. Below this to a depth of about 60 inches is a buried layer of silty clay loam. The upper part is black and firm, and the lower part is very dark gray.

Included with this soil in mapping are some small areas of the poorly drained Colo soils. These soils are lower on the landscape than the Ackmore soil and dry out more slowly after rains. Also, they have a higher content of clay and organic matter. They make up less than 10 percent of the unit.

Permeability is moderate in the Ackmore soil, and runoff is slow. Available water capacity is high. This soil has a seasonal high water table. The content of organic matter is 2 to 4 percent in the surface layer. The shrink-swell potential is moderate in the upper part of the soil and high in the lower part. Reaction typically is neutral to medium acid throughout the soil. The substratum generally has a low supply of available phosphorus and a very low supply of available potassium.

Most areas are cultivated. Some are wooded. This soil is moderately suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. A drainage system is needed to reduce the wetness and provide good aeration and a deep root zone for plants. Tile drains work well if they are properly installed and if an adequate outlet is available. Good tilth generally can be easily maintained. Returning crop residue to the soil or regularly adding other organic material helps to maintain tilth, improves fertility, helps to prevent surface crusting, and increases the rate of water infiltration.

This soil is moderately well suited to grasses and legumes for pasture. Because of flooding, pasture management may be difficult. Permanent pasture can be improved by renovating and reseeding. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods and following periods of flooding help to keep the pasture and the soil in good condition.

This soil is moderately suited to trees. Seedlings do not survive and grow well because of the wetness and the occasional flooding. As a result, they should be spaced close together. Thinning the stand helps to provide adequate growing space for the surviving trees. Protection from flooding can increase the seedling survival rate. Woodlots that are used for grazing are subject to compaction and erosion. Grazing also inhibits tree regeneration and causes root damage, which leads to heartrot and other diseases.

The land capability classification is IIw.

453—Tuskeego silt loam, 0 to 2 percent slopes. This nearly level, poorly drained soil is on low stream terraces, high second bottoms, and concave, low foot slopes. It is subject to rare flooding. Areas range from 5 to more than 100 acres in size and are irregularly shaped.

Typically, the surface layer is very dark gray, friable silt loam about 7 inches thick. The subsurface layer is gray and dark gray, friable silt loam and silty clay loam about 8 inches thick. The subsoil is about 39 inches thick. The upper part is dark gray, firm silty clay loam and silty clay. The next part is gray and grayish brown, firm silty clay and silty clay loam mottled with strong brown. The lower part of the subsoil and the substratum to a depth of about 60 inches are light brownish gray silty clay loam mottled with strong brown.

Permeability is very slow, and runoff is slow. Available water capacity is high. This soil has a seasonal high water table. The content of organic matter is about 2 to 3 percent in the surface layer. The shrink-swell potential is high. The subsoil typically is medium acid or strongly acid in the upper part. It generally has a low supply of available phosphorus and a very low supply of available potassium.

Most areas are cultivated. A few support native hardwoods. This soil is moderately suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. If cultivated crops are grown, a subsurface and surface drainage system is needed to reduce the wetness, provide aeration and a deep root zone for plants, and improve the timeliness of fieldwork. Subsurface drainage systems generally function slowly and sometimes are not beneficial. In many areas measures that help to control the runoff from nearby soils are needed. Tilth generally is fair in the surface layer. Returning crop residue to the soil or regularly adding other organic material and delaying fieldwork when the soil is wet improve fertility and help to prevent deterioration of tilth.

The wetness of this soil restricts the types of grasses or legumes that can be grown for hay and pasture. Grazing should be restricted during wet periods and after periods of flooding.

This soil is moderately suited to trees. The main management concerns are the equipment limitation, seedling mortality, and the windthrow hazard. Logging equipment should be used only during the drier periods or during the winter, when the ground is frozen. Because they do not survive and grow well, seedlings should be planted at close intervals. Thinning the stand helps to provide adequate growing space for the surviving trees. A drainage system that lowers the water table helps to prevent windthrow. Woodlots that are used for grazing are subject to compaction. Grazing also inhibits tree regeneration and causes root damage, which leads to heartrot and other diseases.

The land capability classification is IIIw.

484—Lawson silt loam, 0 to 2 percent slopes. This nearly level, somewhat poorly drained soil is on flood plains along rivers and streams. It is occasionally flooded. Areas are elongated or irregularly shaped. They generally range from 10 to 50 acres in size, but a few are more than 100 acres.

Typically, the surface layer is very dark grayish brown, friable silt loam about 13 inches thick. The subsurface layer is friable silt loam about 30 inches thick. The upper part is black and very dark gray, and the lower part is dark grayish brown. The substratum to a depth of about 60 inches is mottled grayish brown, gray, and light brownish gray silt loam. In places some strata of sand are in the substratum.

Included with this soil in mapping are small areas of the poorly drained Colo soils. These soils make up about 5 to 10 percent of the unit.

Permeability is moderate in the Lawson soil, and runoff is slow. Available water capacity is very high. This soil has a seasonal high water table. The content of organic matter is about 4.5 to 6.0 percent in the surface layer. The subsurface layer typically is neutral or slightly acid. It generally has a medium supply of available phosphorus and a low supply of available potassium.

Most areas are cultivated or are used for hay and pasture. Some support trees. This soil is well suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. Cultivated crops can be grown in most years. The flooding generally is brief. Diversion terraces on adjacent foot slopes help to control the runoff from many of the higher areas. Good tilth generally can be easily maintained. Returning crop residue to the soil and delaying fieldwork when the soil is wet help to prevent deterioration of tilth and improve fertility.

A cover of pasture plants or hay is effective in controlling erosion. Pasture management is difficult in flooded areas. Proper stocking rates, pasture rotation, and timely deferment of grazing or restricted use during wet periods and following periods of flooding help to keep the pasture and the soil in good condition. Permanent pastures can be improved by renovating and reseeding.

The land capability classification is IIw.

499F—Nordness silt loam, 14 to 25 percent slopes. This shallow, moderately steep and steep, well drained soil is on short upland side slopes and escarpments. Areas are 2 to 10 acres in size and are long and narrow.

Typically, the surface layer is dark grayish brown, friable silt loam about 4 inches thick. The subsurface layer also is dark grayish brown, friable silt loam about 4 inches thick. The subsoil is about 9 inches thick. The upper part is brown and dark grayish brown, friable silty clay loam, and the lower part is reddish brown, firm clay. Fractured limestone bedrock is at a depth of about 17 inches. In places the bedrock is sandstone.

Included with this soil in mapping are some areas of limestone and sandstone outcrops and Lindley and Fayette soils. The limestone and sandstone outcrops occur in a random pattern in the mapped areas. Lindley and Fayette soils are on the upper parts of the side slopes. Lindley soils formed in glacial till, and Fayette soils formed in loess. Included areas make up about 15 percent of the unit.

Permeability is moderate in the Nordness soil, and runoff is rapid. Available water capacity is very low. The content of organic matter is 0.5 to about 1.0 percent in the surface layer. The subsoil typically is slightly acid or medium acid. It generally has a very low supply of available phosphorus and potassium.

Most areas support native hardwoods or are used as wildlife habitat. Some small areas are used as permanent pasture. Because of the slope and a severe erosion hazard, this soil is unsuitable for cultivated crops. It is extremely limited as a site for other farm uses. Renovating pasture is difficult because of the shallowness to bedrock. Tilth generally is poor. Ordinary farm machinery cannot be used because limestone slabs are at the surface and slopes generally are too steep. The number of livestock that can graze the pasture without damaging the plant cover is small. As a result, controlled grazing is needed.

This soil is poorly suited to trees. Seedling mortality and the windthrow hazard are severe because of the shallowness to limestone bedrock. The hazards or limitations that affect planting and harvesting are moderate. Woodlots that are used for grazing are subject to compaction and erosion. Grazing also inhibits tree regeneration and causes root damage, which leads to heartrot and other diseases.

The land capability classification is VIIs.

520—Coppock silt loam, 0 to 2 percent slopes. This nearly level, poorly drained soil is on bottom land along the major and minor streams and rivers. It is occasionally flooded. Areas range from 5 to 40 acres in size and are irregularly shaped.

Typically, the surface layer is very dark gray, friable silt loam about 7 inches thick. The subsurface layer is friable silt loam about 19 inches thick. The upper part is dark grayish brown, and the lower part is mottled dark grayish brown and grayish brown. The upper part of the subsoil is grayish brown and light brownish gray, mottled, friable silty clay loam. The lower part to a depth of about 60 inches is grayish brown, mottled, firm silty clay loam. In places, the surface layer is thicker and contains more organic matter and the subsurface layer is thinner. In some areas the subsoil contains more clay.

Permeability is moderate, and runoff is slow. Available water capacity is high. This soil has a seasonal high water table. The content of organic matter is about 2 to 3 percent in the surface layer. The subsoil typically is strongly acid or medium acid. It generally has a medium supply of available phosphorus and a low supply of available potassium.

Many areas are cultivated. Some are used for pasture. A few support native hardwoods. This soil is moderately suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. If the soil is adequately drained and protected from flooding, row crops can be grown in most years. A subsurface drainage system functions satisfactorily if suitable outlets are available. Good tilth generally can be easily maintained.

A cover of pasture plants or hay is effective in controlling erosion. Overgrazing or grazing when the soil is wet causes surface compaction and deterioration of tilth and thus reduces the extent of the protective plant cover.

This soil is well suited to trees. Seedlings survive and grow well. Woodlots that are used for grazing are subject to compaction. Grazing also inhibits tree regeneration and causes root damage, which leads to heartrot and other diseases.

The land capability classification is IIw.

520B—Coppock silt loam, 2 to 5 percent slopes. This gently sloping, poorly drained soil is on foot slopes adjacent to uplands and in some upland drainageways. It is subject to rare flooding. Areas range from 3 to 60 acres in size and are irregularly shaped.

Typically, the surface layer is very dark gray, friable silt loam about 7 inches thick. The subsurface layer is friable silt loam about 19 inches thick. The upper part is dark grayish brown, and the lower part is mottled dark grayish brown and grayish brown. The upper part of the subsoil is grayish brown and light brownish gray, mottled, friable silty clay loam. The lower part to a depth of about 60

inches is grayish brown, mottled, firm silty clay loam. In places the subsoil contains more clay.

Permeability is moderate, and runoff is medium. Available water capacity is high. This soil has a seasonal high water table. The content of organic matter is about 2 to 3 percent in the surface layer. The subsoil typically is strongly acid or medium acid. It generally has a medium supply of available phosphorus and a low supply of available potassium.

Many areas are cultivated. Some are used for pasture. A few support native hardwoods. This soil is moderately suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. If the soil is adequately drained and protected from the runoff from adjacent upland soils, row crops can be grown in most years. A subsurface drainage system functions satisfactorily if suitable outlets are available. Establishing diversion terraces on the foot slopes helps to control the runoff from the higher areas. A system of conservation tillage that leaves crop residue on the surface helps to prevent excessive soil loss. Good tilth generally can be easily maintained.

A cover of pasture plants or hay is effective in controlling erosion. Overgrazing or grazing when the soil is wet, however, causes surface compaction and deterioration of tilth and thus reduces the extent of the protective plant cover.

This soil is well suited to trees. Seedlings survive and grow well, and the hazards or limitations that affect planting and harvesting are slight. Woodlots that are used for grazing are subject to compaction and erosion. Grazing also inhibits tree regeneration and causes root damage, which leads to heartrot and other diseases.

The land capability classification is IIw.

539—Perks sandy loam, 0 to 3 percent slopes. This nearly level and very gently sloping, excessively drained soil is on broad flood plains. It is occasionally flooded. Areas range from 3 to 15 acres in size and are irregularly shaped.

Typically, the surface layer is very dark grayish brown and dark brown, very friable sandy loam about 8 inches thick. The upper part of the substratum is brown, stratified sand and loamy sand. The lower part to a depth of about 60 inches is brown, stratified loamy sand, sand, and sandy loam. In places the surface layer is loamy sand or sand.

Permeability is rapid, and runoff is slow. Available water capacity is very low. The content of organic matter is about 0.5 to 1.5 percent in the surface layer. The substratum typically is medium acid in the upper part. It generally has a very low supply of available phosphorus and potassium.

Most areas are cultivated. A few are wooded. This soil is poorly suited to corn and soybeans and is moderately suited or poorly suited to grasses and legumes for hay and pasture. It is droughty and is subject to wind erosion. A system of conservation tillage that leaves crop residue on the surface conserves moisture and helps to control wind erosion. Good tilth generally can be easily maintained. Returning crop residue to the soil or regularly adding other organic material improves fertility and helps to maintain tilth.

If this soil is used for pasture, overgrazing or grazing when the soil is dry reduces the extent of the plant cover and increases the hazard of wind erosion. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during dry periods help to keep the pasture and the soil in good condition.

This soil is moderately suited to trees. Seedling mortality is a moderate limitation because of the droughtiness. As a result, seedlings should be planted at close intervals and should be watered often. Thinning the stand helps to provide adequate growing space for the surviving trees. Competing vegetation can be controlled by adequate site preparation or by spraying or cutting. Grazing can cause root damage, which leads to heartrot and other diseases.

The land capability classification is IVs.

570B—Nira silty clay loam, 2 to 5 percent slopes. This gently sloping, moderately well drained soil is in coves at the head of drainageways and on the convex tops and sides of ridges in the uplands. Areas range from 5 to 50 acres in size and are irregularly shaped.

Typically, the surface layer is black and very dark gray, friable silty clay loam about 7 inches thick. The subsurface layer is very dark grayish brown, friable silty clay loam about 5 inches thick. The subsoil is mottled, friable silty clay loam about 31 inches thick. The upper part is brown, and the lower part is light brownish gray and grayish brown and is mottled with strong brown. The substratum to a depth of about 60 inches is light brownish gray, mottled silt loam. In places the surface layer is thinner and contains less organic matter because of erosion.

Included with this soil in mapping are small areas of the somewhat poorly drained Mahaska soils. These soils generally are in the higher, less sloping landscape positions. They contain more clay in the subsoil than the Nira soil. They make up about 5 to 10 percent of the unit.

Permeability is moderate in the Nira soil, and runoff is medium. Available water capacity is high. This soil has a seasonal high water table. The content of organic matter is about 3 to 4 percent in the surface layer. The subsoil typically is medium acid or strongly acid. It generally has a low supply of available phosphorus and potassium.

Most areas are cultivated. This soil is well suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. If cultivated crops are grown, erosion is a moderate hazard. A system of conservation tillage that leaves crop residue on the surface, contour farming, and terraces help to prevent

excessive soil loss. Good tilth generally can be easily maintained. Returning crop residue to the soil or regularly adding other organic material improves fertility and helps to maintain tilth.

A cover of pasture plants or hay is effective in controlling erosion. Proper stocking rates, pasture rotation, and timely deferment of grazing help to keep the pasture and the soil in good condition.

The land capability classification is IIe.

570B2—Nira silty clay loam, 2 to 5 percent slopes, moderately eroded. This gently sloping, moderately well drained soil is in coves at the head of drainageways and on the convex tops and sides of ridges in the uplands. Areas range from 5 to 50 acres in size and are irregularly shaped.

Typically, the surface layer is black and very dark gray, friable silty clay loam about 10 inches thick. Because of plowing, it has some streaks and pockets of brown subsoil material. The subsoil is mottled, friable silty clay loam about 30 inches thick. The upper part is brown, and the lower part is light brownish gray and grayish brown and is mottled with strong brown. The substratum to a depth of about 60 inches is light brownish gray, mottled silt loam. In places the surface layer is brown and is lower in content of organic matter because of severe erosion.

Included with this soil in mapping are small areas of the somewhat poorly drained Mahaska soils. These soils generally are in the higher, slightly less sloping landscape positions. They contain more clay in the subsoil than the Nira soil. They make up about 5 to 10 percent of the unit.

Permeability is moderate in the Nira soil, and runoff is medium. Available water capacity is high. This soil has a seasonal high water table. The content of organic matter is about 2.5 to 3.0 percent in the surface layer. The subsoil typically is medium acid or strongly acid. It generally has a low supply of available phosphorus and potassium.

Most areas are cultivated. This soil is well suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. If cultivated crops are grown, further erosion is a moderate hazard. A system of conservation tillage that leaves crop residue on the surface, contour farming, and terraces help to prevent excessive soil loss. Tilth generally is fair in the surface layer. Returning crop residue to the soil or regularly adding other organic material improves fertility and tilth.

A cover of pasture plants or hay is effective in controlling erosion. Proper stocking rates, pasture rotation, and timely deferment of grazing help to keep the pasture and the soil in good condition.

The land capability classification is IIe.

570C2—Nira silty clay loam, 5 to 9 percent slopes, moderately eroded. This moderately sloping, moderately well drained soil is in coves at the head of drainageways and on short, convex side slopes in the uplands. Areas range from 5 to 50 acres in size and are irregularly shaped.

Typically, the surface layer is black and very dark gray, friable silty clay loam about 10 inches thick. Because of plowing, it has some streaks and pockets of brown subsoil material. The subsoil is mottled, friable silty clay loam about 28 inches thick. The upper part is brown, and the lower part is light brownish gray and grayish brown and is mottled with strong brown. The substratum to a depth of about 60 inches is light brownish gray, mottled silt loam. In places the surface layer is brown and is lower in content of organic matter because of severe erosion.

Included with this soil in mapping are areas of the poorly drained Clarinda soils on the lower slopes. These soils are seepy during wet periods. They have a subsoil of gray clay. They make up less than 5 percent of the unit.

Permeability is moderate in the Nira soil, and runoff is medium. Available water capacity is high. This soil has a seasonal high water table. The content of organic matter is about 2 to 3 percent in the surface layer. The subsoil typically is medium acid or strongly acid. It generally has a low supply of available phosphorus and potassium.

Most areas are cultivated. Some are used for hay and pasture. This soil is moderately suited to corn, soybeans, and small grain and well suited to grasses and legumes for hay and pasture. If cultivated crops are grown, further erosion is a severe hazard. A system of conservation tillage that leaves crop residue on the surface, contour farming, and terraces help to prevent excessive soil loss. In places, however, contour farming and terracing are difficult because of short, irregular slopes. Tilth generally is fair in the surface layer. Returning crop residue to the soil or regularly adding other organic material improves fertility and tilth.

A cover of pasture plants or hay is effective in controlling erosion. Proper stocking rates, pasture rotation, and timely deferment of grazing help to keep the pasture and the soil in good condition.

The land capability classification is IIIe.

570C3—Nira silty clay loam, 5 to 9 percent slopes, severely eroded. This moderately sloping, moderately well drained soil is in coves at the head of drainageways and on short, convex side slopes in the uplands. Areas range from 5 to 50 acres in size and are irregularly shaped.

Typically, the surface layer is brown, friable silty clay loam about 8 inches thick. Very dark gray streaks and pockets make up 10 to 15 percent of this layer. The subsoil is mottled, friable silty clay loam about 22 inches thick. The upper part is brown, and the lower part is light brownish gray and grayish brown and is mottled with

strong brown. The substratum to a depth of about 60 inches is light brownish gray, mottled silt loam.

Included with this soil in mapping are areas of the poorly drained Clarinda soils on the lower slopes. These soils are seepy during wet periods. They have a subsoil of gray clay. They make up less than 5 percent of the unit.

Permeability is moderate in the Nira soil, and runoff is rapid. Available water capacity is high. This soil has a seasonal high water table. The content of organic matter is about 0.5 to 2.0 percent in the surface layer. The subsoil typically is medium acid or strongly acid. It generally has a low supply of available phosphorus and potassium.

Most areas are cultivated. Some are used for hay and pasture. This soil is poorly suited to corn, soybeans, and small grain. If cultivated crops are grown, further erosion is a severe hazard. The surface layer tends to seal and crust when worked. As a result, the rate of water infiltration is reduced and the runoff rate is increased. The increased runoff rate accelerates sheet and gully erosion. A system of conservation tillage that leaves crop residue on the surface, contour farming, and terraces help to prevent excessive soil loss. In places, however, contour farming or terracing is difficult because of short, irregular slopes.

Tilth generally is poor in the surface layer of this soil. Surface crusting is a problem. It adversely affects seedling emergence. Returning crop residue to the soil or regularly adding other organic material improves fertility, helps to prevent surface crusting, and increases the rate of water infiltration. More nitrogen and more intensive management are needed on this soil than on less eroded Nira soils.

This soil is moderately suited to grasses and legumes for hay and pasture. A cover of pasture plants or hay is effective in controlling erosion. Proper stocking rates, pasture rotation, and timely deferment of grazing help to keep the pasture and the soil in good condition.

The land capability classification is IVe.

571B—Hedrick silt loam, 2 to 5 percent slopes. This gently sloping, moderately well drained soil is in coves at the head of drainageways and on convex side slopes in the uplands. Areas range from 5 to 40 acres in size and are irregularly shaped.

Typically, the surface layer is very dark grayish brown silt loam about 8 inches thick. The subsurface layer is brown silt loam about 2 inches thick. The subsoil is silty clay loam about 45 inches thick. The upper part is dark yellowish brown, brown, and yellowish brown, is mottled with grayish brown, and is firm, and the lower part is light brownish gray, is mottled with strong brown, and is friable. The substratum to a depth of about 60 inches is light brownish gray, mottled silty clay loam. In places the surface layer is silty clay loam.

Included with this soil in mapping are areas of the somewhat poorly drained Givin soils. These soils generally are in landscape positions similar to those of the Hedrick soil. They contain more clay in the subsoil than the Hedrick soil. They make up about 5 to 10 percent of the unit.

Permeability is moderate in the Hedrick soil, and runoff is medium. Available water capacity is high. This soil has a seasonal high water table. The content of organic matter is about 2 to 3 percent in the surface layer. The subsoil typically is medium acid or strongly acid. It generally has a medium supply of available phosphorus and a low supply of available potassium.

Most areas are cultivated. Some are used for hay and pasture. A few areas support native hardwoods. This soil is well suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. If cultivated crops are grown, erosion is a moderate hazard. A system of conservation tillage that leaves crop residue on the surface, contour farming, and terraces help to prevent excessive soil loss. Good tilth generally can be easily maintained. Returning crop residue to the soil or regularly adding other organic material improves fertility and helps to prevent deterioration of tilth.

A cover of hay or pasture plants is effective in controlling erosion. Proper stocking rates, pasture rotation, and timely deferment of grazing help to keep the pasture and the soil in good condition.

This soil is well suited to trees. Seedlings survive and grow well, and the hazards or limitations that affect planting and harvesting are slight. Woodlots that are used for grazing are subject to compaction and erosion. Grazing also inhibits tree regeneration and causes root damage, which leads to heartrot and other diseases.

The land capability classification is IIe.

571B2—Hedrick silt loam, 2 to 5 percent slopes, moderately eroded. This gently sloping, moderately well drained soil is in coves at the head of drainageways and on convex side slopes in the uplands. Areas range from 5 to 40 acres in size and are irregularly shaped.

Typically, the surface layer is very dark grayish brown, friable silt loam about 8 inches thick. Because of plowing, it has some streaks and pockets of brown silty clay loam subsoil material. The subsoil is silty clay loam about 40 inches thick. The upper part is dark yellowish brown, brown, and yellowish brown, is mottled with grayish brown, and is firm, and the lower part is light brownish gray, is mottled with strong brown, and is friable. The substratum to a depth of about 60 inches is light brownish gray, mottled silty clay loam.

Included with this soil in mapping are areas of the somewhat poorly drained Givin soils. These soils generally are in landscape positions similar to those of the Hedrick soil. They contain more clay in the subsoil than the Hedrick soil. They make up about 5 to 10 percent of the unit.

Permeability is moderate in the Hedrick soil, and runoff is medium. Available water capacity is high. This soil has a seasonal high water table. The content of organic matter is about 1 to 2 percent in the surface layer. The subsoil typically is medium acid or strongly acid. It generally has a medium supply of available phosphorus and a low supply of available potassium.

Many areas are cultivated. Some are used for hay and pasture. A few small areas support native hardwoods. This soil is well suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. If cultivated crops are grown, erosion is a moderate hazard. A system of conservation tillage that leaves crop residue on the surface, contour farming, and terraces help to prevent excessive soil loss. Tilth generally is fair in the surface layer. Returning crop residue to the soil or regularly adding other organic material improves fertility and helps to prevent deterioration of tilth.

A cover of hay or pasture plants is effective in controlling erosion. Proper stocking rates, pasture rotation, and timely deferment of grazing help to keep the pasture and the soil in good condition.

This soil is well suited to trees. Seedlings survive and grow well, and the hazards or limitations that affect planting and harvesting are slight. Woodlots that are used for grazing are subject to compaction and erosion. Grazing also inhibits tree regeneration and causes root damage, which leads to heartrot and other diseases.

The land capability classification is IIe.

571C2—Hedrick silt loam, 5 to 9 percent slopes, moderately eroded. This moderately sloping, moderately well drained soil is in coves at the head of drainageways and on somewhat short, convex and plane side slopes in the uplands. Areas range from 5 to 40 acres in size and are irregularly shaped.

Typically, the surface layer is very dark grayish brown, friable silt loam about 8 inches thick. Because of plowing, it has some streaks and pockets of brown silty clay loam subsoil material. The subsoil is silty clay loam about 45 inches thick. The upper part is dark yellowish brown, brown, and yellowish brown, is mottled with grayish brown, and is firm, and the lower part is light brownish gray, is mottled with strong brown, and is friable. The substratum to a depth of about 60 inches is light brownish gray, mottled silty clay loam. In places the surface layer is brown silty clay loam and is lower in content of organic matter because of severe erosion.

Included with this soil in mapping are areas of the poorly drained Rinda soils on the lower slopes. These soils are seepy during wet periods. They have a subsoil that contains more clay and is more slowly permeable than that of the Hedrick soil. They make up less than 5 percent of the unit.

Permeability is moderate in the Hedrick soil, and runoff is medium. Available water capacity is high. This soil has a seasonal high water table. The content of organic matter is about 0.5 to 1.5 percent in the surface layer. The subsoil typically is medium acid or strongly acid. It generally has a medium supply of available phosphorus and a low supply of available potassium.

Most areas are cultivated or used for hay and pasture. A few support native hardwoods. This soil is moderately suited to corn, soybeans, and small grain and well suited to grasses and legumes for hay and pasture. If cultivated crops are grown, further erosion is a severe hazard. A system of conservation tillage that leaves crop residue on the surface, contour farming, and terracing help to prevent excessive soil loss. In places, however, contour farming and terracing are difficult because of short, irregular slopes. Tilth generally is fair in the surface layer. Returning crop residue to the soil or regularly adding other organic material improves fertility and tilth.

A cover of pasture plants or hay is effective in controlling erosion. Proper stocking rates, pasture rotation, and timely deferment of grazing help to keep the pasture and the soil in good condition.

This soil is well suited to trees. Seedlings survive and grow well. Woodlots that are used for grazing are subject to compaction and erosion. Grazing also inhibits tree regeneration and causes root damage, which leads to heartrot and other diseases.

The land capability classification is IIIe.

571C3—Hedrick silty clay loam, 5 to 9 percent slopes, severely eroded. This moderately sloping, moderately well drained soil is in coves at the head of drainageways and on somewhat short, convex and plane side slopes in the uplands. Areas range from 5 to 40 acres in size and are irregularly shaped.

Typically, the surface layer is brown, firm silty clay loam about 7 inches thick. Very dark grayish brown streaks and pockets make up 10 to 15 percent of this layer. The subsoil is silty clay loam about 30 inches thick. The upper part is dark yellowish brown, brown, and yellowish brown, is mottled with grayish brown, and is firm, and the lower part is light brownish gray, is mottled with strong brown, and is friable. The substratum to a depth of about 60 inches is light brownish gray and mottled. The upper part is silty clay loam, and the lower part is silt loam.

Included with this soil in mapping are areas of the poorly drained Rinda soils on the lower slopes. These soils are seepy during wet periods. They have a subsoil that contains more clay and is more slowly permeable than that of the Hedrick soil. They make up less than 5 percent of the unit.

Permeability is moderate in the Hedrick soil, and runoff is rapid. Available water capacity is high. This soil has a seasonal high water table. The content of organic matter is less than 0.5 percent to 1.0 percent in the surface layer. The subsoil typically is medium acid or strongly acid. It generally has a medium supply of available phosphorus and a low supply of available potassium.

Most areas are cultivated or are used for hay and pasture. This soil is poorly suited to corn, soybeans, and small grain. If cultivated crops are grown, further erosion is a severe hazard. The surface layer tends to seal and crust when worked. As a result, the rate of water infiltration is reduced and the runoff rate is increased. The increased runoff rate accelerates sheet and gully erosion. A system of conservation tillage that leaves crop residue on the surface, contour farming, and terracing help to prevent excessive soil loss. In places, however, contour farming or terracing is difficult because of short, irregular slopes.

Tilth generally is poor in the surface layer of this soil. Surface crusting is a problem. It adversely affects seedling emergence. Returning crop residue to the soil or regularly adding other organic material improves fertility, helps to prevent surface crusting, and increases the rate of water infiltration. More nitrogen and more intensive management are needed on this soil than on less eroded Hedrick soils.

This soil is moderately suited to grasses and legumes for hay and pasture. A cover of pasture plants or hay is effective in controlling erosion. Proper stocking rates, pasture rotation, and timely deferment of grazing help to keep the pasture and the soil in good condition.

This soil is moderately well suited to trees. Seedlings do not survive well. As a result, they should be spaced close together. Thinning the stand helps to provide adequate growing space for surviving trees. Woodlots that are used for grazing are subject to compaction and erosion. Grazing also inhibits tree regeneration and causes root damage, which leads to heartrot and other diseases.

The land capability classification is IVe.

572B—Inton silt loam, 2 to 5 percent slopes. This gently sloping, moderately well drained soil is on short, convex and plane side slopes and around the head of drainageways in the uplands. Areas range from 5 to 20 acres in size and are irregularly shaped.

Typically, the surface layer is dark grayish brown, friable silt loam about 5 inches thick. The subsoil is firm and friable silty clay loam about 45 inches thick. The upper part is yellowish brown, and the lower part is grayish brown and light brownish gray and is mottled with strong brown. The substratum to a depth of about 60 inches is light brownish gray, mottled silt loam.

Included with this soil in mapping are areas of the somewhat poorly drained Keomah soils. These soils generally are in landscape positions similar to those of the Inton soil. They have a subsoil that contains more clay than that of the Inton soil. They make up about 5 to 10 percent of the unit.

Permeability is moderate in the Inton soil, and runoff is medium. Available water capacity is high. This soil has a seasonal high water table. The content of organic matter is about 1 to 2 percent in the surface layer. The subsoil typically is strongly acid. It generally has a medium supply of available phosphorus and a low supply of available potassium.

Most areas are cultivated or are used for hay and pasture. Some support native hardwoods. This soil is well suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. If cultivated crops are grown, erosion is a hazard. Terraces, contour farming, and a system of conservation tillage that leaves crop residue on the surface help to prevent excessive soil loss. Good tilth generally can be easily maintained. Returning crop residue to the soil or regularly adding other organic material improves fertility, helps to control erosion, helps to prevent surface crusting and deterioration of tilth, and increases the rate of water infiltration.

A cover of pasture plants or hay is effective in controlling erosion. Overgrazing, however, causes surface compaction, excessive runoff, and deterioration of tilth and thus reduces the extent of the protective plant cover. Proper stocking rates, pasture rotation, and timely deferment of grazing help to keep the pasture and the soil in good condition.

This soil is well suited to trees. Seedlings survive and grow well. Woodlots that are used for grazing are subject to compaction and erosion. Grazing also inhibits tree regeneration and causes root damage, which leads to heartrot and other diseases.

The land capability classification is IIe.

572C2—Inton silt loam, 5 to 9 percent slopes, moderately eroded. This moderately sloping, moderately well drained soil is on short, convex and nearly plane side slopes and around the head of drainageways in the uplands. Areas range from 5 to 40 acres in size and are irregularly shaped.

Typically, the surface layer is dark grayish brown, friable silt loam about 6 inches thick. Because of plowing, it has some streaks and pockets of yellowish brown silty clay loam subsoil material. The subsoil is firm and friable silty clay loam about 35 inches thick. The upper part is yellowish brown, and the lower part is grayish brown and light brownish gray and is mottled with strong brown. The substratum to a depth of about 60 inches is light brownish gray, mottled silt loam. In places the surface layer is yellowish brown silty clay loam and is lower in content of organic matter because of severe erosion.

Included with this soil in mapping are areas of the poorly drained Ashgrove soils on the lower slopes. These soils are seepy during wet periods. They have a subsoil that contains more clay than that of the Inton soil. They make up less than 5 percent of the unit.

Permeability is moderate in the Inton soil, and runoff is medium. Available water capacity is high. This soil has a seasonal high water table. The content of organic matter is about 0.5 to 1.0 percent in the surface layer. The

subsoil typically is strongly acid. It generally has a medium supply of available phosphorus and a low supply of available potassium.

Most areas are cultivated or are used for hay and pasture. This soil is moderately suited to corn, soybeans, and small grain and well suited to grasses and legumes for hay and pasture. If cultivated crops are grown, further erosion is a hazard. Terraces, contour farming, and a system of conservation tillage that leaves crop residue on the surface help to prevent excessive soil loss. In places, however, contour farming and terracing are difficult because of short, irregular slopes. Tilth generally is fair in the surface layer. Returning crop residue to the soil or regularly adding other organic material improves fertility and tilth, helps to prevent surface crusting, and increases the rate of water infiltration.

A cover of pasture plants or hay is effective in controlling erosion. Overgrazing, however, causes surface compaction, excessive runoff, and deterioration of tilth and thus reduces the extent of the protective plant cover. Proper stocking rates, pasture rotation, and timely deferment of grazing help to keep the pasture and the soil in good condition.

This soil is well suited to trees. Seedlings survive and grow well. Woodlots that are used for grazing are subject to compaction and erosion. Grazing also inhibits tree regeneration and causes root damage, which leads to heartrot and other diseases.

The land capability classification is IIIe.

592D2—Mystic loam, 9 to 14 percent slopes, moderately eroded. This strongly sloping, somewhat poorly drained soil is on the sides of high benches that border valleys along the major streams and their tributaries. Areas range from 5 to 30 acres in size and are irregularly shaped.

Typically, the surface layer is very dark grayish brown and very dark gray, friable loam about 7 inches thick. Because of plowing, it has some streaks and pockets of brown clay subsoil material. The subsoil is about 49 inches thick. The upper part is brown and grayish brown, very firm clay mottled with red and dusky red; the next part is grayish brown, firm clay loam mottled with strong brown and red; and the lower part is grayish brown and light brownish gray, friable sandy clay loam mottled with strong brown. The substratum to a depth of about 60 inches is mixed light brownish gray, strong brown, and yellowish brown sandy clay loam.

Included with this soil in mapping are some small areas of Nordness soils. These soils are generally at the base of side slopes, where limestone or sandstone is near or at the surface. They make up less than 2 percent of the unit.

Permeability is slow in the Mystic soil, and runoff is rapid. Available water capacity is high. This soil has a seasonal high water table. The content of organic matter is about 0.5 to 1.5 percent in the surface layer. The shrink-swell potential is high. Reaction typically is very strongly acid in the upper part of the subsoil. The subsoil generally has a very low supply of available phosphorus and potassium.

Most areas are used for hay and pasture or are cultivated. A few support native hardwoods. This soil is poorly suited to corn, soybeans, and small grain and moderately suited to hay and pasture. If cultivated crops are grown, further erosion is a severe hazard. A system of conservation tillage that leaves crop residue on the surface and contour farming help to prevent excessive soil loss. If terraces are constructed, cuts should be shallow enough to prevent exposure of the subsoil. Because the soil is seepy, the terrace channels can be wet. Measures that help to prevent compaction of the surface layer are needed. Also, the soil should not be worked during wet periods. Tilth generally is fair. Returning crop residue to the soil or regularly adding other organic material and deferring tillage when the soil is wet improve tilth and fertility, help to prevent surface crusting, and increase the rate of water infiltration.

A cover of pasture plants or hay is effective in controlling erosion. Overgrazing or grazing when the soil is wet, however, causes surface compaction and poor tilth, increases the runoff rate, and reduces forage production. Proper stocking rates, pasture rotation, and timely deferment of grazing help to keep the pasture and the soil in good condition.

This soil is moderately suited to trees. The main management concern is the windthrow hazard, which is caused by a shallow rooting depth. Seedlings do not survive and grow well. As a result, they should be spaced close together. Thinning the stand helps to provide adequate growing space for the surviving trees. Woodlots that are used for grazing are subject to compaction and erosion. Grazing also inhibits tree regeneration and causes root damage, which leads to heartrot and other diseases.

The land capability classification is IVe.

687B—Watkins silt loam, 1 to 5 percent slopes. This very gently sloping and gently sloping, moderately well drained soil is on convex slopes on stream terraces or high second bottoms along the major streams and their tributaries. It is subject to rare flooding. Areas range from 3 to 20 acres in size and are irregularly shaped.

Typically, the surface layer is very dark grayish brown, friable silt loam about 8 inches thick. The subsurface layer is dark grayish brown and brown, friable silt loam about 6 inches thick. The subsoil is friable silty clay loam about 35 inches thick. The upper part is brown, the next part is yellowish brown, and the lower part is mottled light olive brown and light brownish gray. The substratum to a depth of about 60 inches is light brownish gray silt loam and loam. In places the soil is steeper.

Included with this soil in mapping are areas of the somewhat poorly drained Koszta soils. These soils are

on the more nearly level parts of the landscape. They make up about 5 to 10 percent of the unit.

Permeability is moderate in the Watkins soil, and runoff is medium. Available water capacity is high. The content of organic matter is about 2 to 3 percent in the surface layer. The subsoil typically is medium acid or strongly acid. It generally has a medium supply of available phosphorus and a low supply of available potassium.

Most areas are cultivated or are used for pasture. Some areas are wooded. This soil is well suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. If cultivated crops are grown, erosion is a hazard. A system of conservation tillage that leaves crop residue on the surface helps to prevent excessive soil loss. Terracing and contour farming are impractical because areas of this soil are small and isolated and because the adjacent soils are nearly level. Good tilth generally can be easily maintained. Returning crop residue to the soil or regularly adding other organic material improves fertility, helps to prevent surface crusting, and increases the rate of water infiltration.

A cover of pasture plants or hay is effective in controlling erosion. Overgrazing or grazing when the soil is too wet, however, causes surface compaction and increases the likelihood of puddling. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and the soil in good condition.

This soil is well suited to trees. Seedlings survive and grow well if competing vegetation is controlled by careful site preparation or by spraying or cutting. Woodlots that are used for grazing are subject to compaction and erosion. Grazing also inhibits tree regeneration and causes root damage, which leads to heartrot and other diseases.

The land capability classification is IIe.

688—Koszta silt loam, 0 to 2 percent slopes. This nearly level, somewhat poorly drained soil is on stream benches or high second bottoms along the major streams and their tributaries. It is subject to rare flooding. Areas range from 5 to more than 80 acres in size and are irregularly shaped.

Typically, the surface layer is very dark grayish brown, friable silt loam about 8 inches thick. The subsurface layer is dark grayish brown, friable silt loam about 6 inches thick. The subsoil is silty clay loam about 37 inches thick. The upper part is brown and grayish brown and is friable, the next part is grayish brown and light olive brown and is firm, and the lower part is grayish brown and light brownish gray, is mottled with strong brown, and is firm. The substratum to a depth of about 60 inches is light brownish gray, mottled silty clay loam.

Included with this soil in mapping are small areas of the poorly drained Tuskeego soils. These soils are in nearly level or slightly depressional areas. They contain more clay in the subsoil than the Koszta soil and are more slowly permeable. They make up about 5 to 10 percent of the unit.

Permeability is moderate in the Koszta soil, and runoff is slow. Available water capacity is high. The content of organic matter typically is about 2 to 3 percent in the surface layer. The subsoil typically is medium acid or strongly acid. It generally has a high supply of available phosphorus and a low supply of available potassium.

Most areas are cultivated. A few small areas support native hardwoods. This soil is well suited to corn, soybeans, and small grain. Most areas are adequately drained. In some areas, however, tile drains are needed to improve the timeliness of fieldwork in wet years. Returning crop residue to the soil and delaying fieldwork when the soil is wet help to prevent deterioration of tilth and improve fertility.

This soil is well suited to grasses and legumes for hay and pasture. Maximum production can be achieved if the pasture or hayland is well managed. Applications of fertilizer, weed and brush control, rotation and deferred grazing, proper stocking rates, and adequate livestock watering facilities help to keep the pasture or hayland in good condition.

This soil is suited to trees. Seedlings can survive and grow well if competing vegetation is controlled by careful site preparation or by spraying, cutting, or girdling. Woodlots that are used for grazing are subject to compaction. Grazing also inhibits tree regeneration and causes root damage, which leads to heartrot and other diseases.

The land capability classification is I.

715—Nodaway-Perks complex, 0 to 3 percent slopes. These nearly level and very gently sloping soils are on bottom land adjacent to rivers and some of the major streams. The excessively drained Perks soil typically is on slight rises above the moderately well drained Nodaway soil. Both soils are subject to flooding. Individual areas range from 10 to more than 100 acres in size and are irregularly shaped. They are about 65 percent Nodaway soil and 20 percent Perks soil. The two soils occur as areas so intricately mixed or so small that mapping them separately is impractical.

Typically, the surface layer of the Nodaway soil is very dark grayish brown, friable silt loam about 8 inches thick. The substratum to a depth of about 60 inches is stratified very dark gray, dark grayish brown, and grayish brown silt loam. In places, the surface layer is sandy and seedling emergence is restricted because of droughtiness.

Typically, the surface layer of the Perks soil is very dark grayish brown and dark brown, very friable sandy loam about 8 inches thick. The upper part of the substratum is brown, stratified sand and loamy sand. The lower part to a depth of about 60 inches is brown,

stratified loamy sand, sand, and sandy loam. In places the surface layer is loamy sand or sand.

Included with these soils in mapping are small areas of Ackmore and Colo soils. Ackmore soils are stratified silt loam in the upper part and are underlain by a buried soil of black silty clay loam. Colo soils are black silty clay loam throughout and contain more organic matter than the Nodaway and Perks soils. Ackmore and Colo soils are more poorly drained than the Nodaway and Perks soils. They are in slight depressions or in nearly level areas below the Nodaway and Perks soils. They make up about 15 percent of the unit.

Permeability is moderate in the Nodaway soil and rapid in the Perks soil. Runoff is slow on both soils. Available water capacity is high in the Nodaway soil and very low in the Perks soil. The Nodaway soil has a seasonal high water table. The content of organic matter is 0.5 to 2.0 percent in the surface layer of both soils. The substratum of the Nodaway soil typically is neutral or slightly acid, and that of the Perks soil is slightly acid or medium acid. The Nodaway soil generally has a medium supply of available phosphorus and a very low supply of available phosphorus and potassium.

Most areas are wooded. Some are cultivated or are used for hay and pasture. These soils generally are unsuited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. Because of flooding in the spring, planting is normally delayed. The flooding that occurs after planting may cause severe crop damage in some years. Levees could help to control flooding in some areas. Because they must be located close to the river, however, they are subject to occasional damage.

Pasture management is difficult because these soils are subject to flooding. Proper stocking rates, pasture rotation, and timely deferment of grazing during wet periods and after periods of flooding help to keep the pasture and the soil in good condition.

These soils are moderately suited to trees. Seedling mortality is moderate on the Perks soil because of droughtiness. It is a limitation on both soils because of the flooding. Seedlings should be planted at close intervals on the Perks soil and should be watered often. Competing vegetation can be controlled by adequate site preparation or by spraying and cutting. Woodlots that are used for grazing are subject to compaction. Grazing also inhibits tree regeneration and causes root damage, which leads to heartrot and other diseases.

The land capability classification is Vw.

729B—Ackmore-Nodaway silt loams, 2 to 5 percent slopes. These gently sloping soils are in upland drainageways. They are occasionally flooded. The Ackmore soil is somewhat poorly drained, and the Nodaway soil is moderately well drained. Areas range from 5 to more than 100 acres in size and are elongated and irregularly shaped. They are about 55 percent Ackmore soil and 45 percent Nodaway soil. The two soils occur as areas so intricately mixed or so small and narrow that mapping them separately is impractical.

Typically, the surface layer of the Ackmore soil is dark grayish brown, friable silt loam about 8 inches thick. The substratum is stratified dark grayish brown, very dark gray, brown, and very dark grayish brown silt loam about 18 inches thick. Below this to a depth of about 60 inches is a buried layer of silty clay loam. The upper part is black and firm, and the lower part is very dark gray. In places the soil has 10 to 18 inches of loamy and sandy overwash.

Typically, the surface layer of the Nodaway soil is very dark grayish brown, friable silt loam about 8 inches thick. The substratum to a depth of about 60 inches is stratified very dark gray, dark grayish brown, and grayish brown silt loam.

Permeability is moderate in both soils, and runoff is medium. Available water capacity is high. The content of organic matter ranges from 1 to 4 percent in the surface layer. The shrink-swell potential is high in the buried layer of the Ackmore soil. The substratum of both soils typically ranges from medium acid to neutral. It generally has a medium or low supply of available phosphorus and a very low supply of available potassium.

Most areas are used for hay and pasture or are cultivated. Some are wooded. These soils are moderately suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. Many areas are in very narrow drainageways that cannot be cultivated. If cultivated, these areas can become excessively gullied because of rapid runoff from the adjacent upland slopes. For this reason, many of these areas have a cover of grasses or are used for permanent pasture. In the areas large enough to be cultivated, excess water should be diverted. In areas that are seasonally wet because of seepage from the soils upslope, drainage tile can improve the timeliness of fieldwork. Tilth generally is good. Returning crop residue to the soil or regularly adding other organic material improves fertility and helps to maintain good tilth.

A cover of pasture plants is effective in controlling erosion. Proper stocking rates, pasture rotation, and restricted use during wet periods help to keep the pasture and the soils in good condition.

These soils are moderately well suited to trees. The main management concern is the windthrow hazard on the somewhat poorly drained Ackmore soil. A drainage system that lowers the water table in this soil helps to prevent windthrow. Seedlings survive and grow well if the site is protected from runoff during critical periods of seedling development. Woodlots that are used for grazing are subject to compaction and erosion. Grazing also inhibits tree regeneration and causes root damage, which leads to heartrot and other diseases.

The land capability classification is IIw.

779—Kalona silty clay loam, 0 to 2 percent slopes. This nearly level, poorly drained soil is on broad flats in the uplands. Areas range from 50 to 300 acres in size and are irregularly shaped.

Typically, the surface layer is black, firm silty clay loam about 7 inches thick. The subsurface layer also is black, firm silty clay loam. It is about 12 inches thick. The subsoil is about 29 inches thick. It is firm. The upper part is dark gray and dark grayish brown silty clay, and the lower part is grayish brown and olive gray silty clay loam mottled with strong brown. The substratum to a depth of about 60 inches is light olive gray and gray silty clay loam.

Permeability is moderately slow, and runoff is slow. Available water capacity is high. This soil has a seasonal high water table. The content of organic matter is about 5 to 6 percent in the surface layer. The shrink-swell potential is high. The subsoil typically is medium acid to neutral. It generally has a very low supply of available phosphorus and potassium.

Most areas are cultivated. This soil is well suited to corn, soybeans, and small grain. If cultivated crops are grown, a subsurface drainage system is needed to reduce the wetness and provide good aeration and a deep root zone for plants. Tile drains function satisfactorily, but in some areas suitable outlets are not available. A surface drainage system is needed in some areas. Tilth generally is fair or poor in the surface layer. Returning crop residue to the soil and delaying fieldwork when the soil is wet improve tilth.

This soil is well suited to grasses and legumes for hay and pasture. Overgrazing or grazing when the soil is wet, however, causes surface compaction and poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and the soil in good condition.

The land capability classification is IIw.

792C2—Armstrong silt loam, 5 to 9 percent slopes, moderately eroded. This moderately sloping, somewhat poorly drained soil is on convex side slopes and ridgetops in the uplands. Areas range from 5 to 20 acres in size and are irregularly shaped.

Typically, the surface layer is dark brown, friable silt loam about 8 inches thick. Because of plowing, it has some streaks and pockets of brown and yellowish red clay loam subsoil material. The subsoil extends to a depth of about 60 inches. The upper part is yellowish red, firm clay loam; the next part is brown and strong brown, firm clay and clay loam mottled with red and dark red; and the lower part is strong brown and yellowish brown, firm clay loam mottled with grayish brown. In places the surface layer is brown and yellowish red, firm clay loam and is lower in content of organic matter because of severe erosion.

Included with this soil in mapping are small areas of Rinda soils. These soils are on the upper side slopes. They do not have pebbles. They are grayer than the Armstrong soil and are more poorly drained. They make up less than 15 percent of the unit.

Permeability is slow in the Armstrong soil, and runoff is medium. Available water capacity is high. This soil has a seasonal high water table. The shrink-swell potential is high. The content of organic matter typically is about 0.5 to 2.0 percent in the surface layer. The subsoil typically is medium acid to very strongly acid. It generally has a very low supply of available phosphorus and potassium.

Most areas are cultivated. Some are used for hay or pasture. A few small areas support native hardwoods. This soil is moderately suited or poorly suited to corn, soybeans, and small grain. If cultivated crops are grown, further erosion is a severe hazard. It can be controlled in intensively row cropped areas by a system of conservation tillage that leaves crop residue on the surface, terraces, contour farming, grassed waterways, and a cropping sequence that includes grasses and legumes. A combination of these measures is needed. If terraces are constructed, cuts should be shallow enough to prevent exposure to the clayey subsoil.

Tilth generally is fair in the surface layer. Because this soil is seepy when wet, measures that help to prevent compaction of the surface layer are needed. Also, the soil should not be worked during wet periods. Returning crop residue to the soil or regularly adding other organic material improves fertility, helps to prevent surface crusting, and increases the rate of water infiltration.

This soil is moderately suited to grasses and legumes for hay and pasture. Maximum production can be achieved if the pasture or hayland is well managed. Applications of fertilizer, weed and brush control, rotation and deferred grazing, proper stocking rates, and adequate livestock watering facilities help to keep the pasture or hayland in good condition. If the pasture or hayland is tilled, further erosion is a severe hazard. As a result, the grasses and legumes should be interseeded into the existing sod.

This soil is moderately suited to trees. The main management concerns are the windthrow hazard and seedling mortality. The windthrow hazard is caused by a shallow rooting depth. Seedlings do not survive and grow well. As a result, they should be planted at close intervals. Thinning the stand helps to provide adequate growing space for the surviving trees. Woodlots that are used for grazing are subject to compaction and erosion. Grazing also inhibits tree regeneration and causes root damage, which leads to heartrot and other diseases.

The land capability classification is IIIe.

792D2—Armstrong silt loam, 9 to 14 percent slopes, moderately eroded. This strongly sloping, somewhat poorly drained soil is on convex side slopes and nose slopes in the uplands. Areas range from 3 to 25 acres in size and are irregularly shaped.

Typically, the surface layer is dark brown, friable silt loam about 8 inches thick. Because of plowing, it has some streaks and pockets of brown and yellowish red clay loam subsoil material. The subsoil extends to a depth of about 60 inches. The upper part is yellowish red, firm clay loam; the next part is brown and strong brown, firm clay and clay loam mottled with red and dark red; and the lower part is strong brown and yellowish brown, firm clay loam mottled with grayish brown. In places the surface layer is brown and yellowish red clay loam and is lower in content of organic matter because of severe erosion.

Included with this soil in mapping are small areas of Rinda soils on the upper parts of the landscape. These soils do not have pebbles. They are grayer than the Armstrong soil and are more poorly drained. They make up less than 15 percent of the unit.

Permeability is slow in the Armstrong soil, and runoff is rapid. Available water capacity is high. This soil has a seasonal high water table. The shrink-swell potential is high. The content of organic matter typically is about 0.5 to 1.5 percent. The subsoil typically is medium acid to very strongly acid. It generally has a very low supply of available phosphorus and potassium.

Most areas are cultivated or are used for hay or pasture. This soil is poorly suited to corn, soybeans, and small grain. If cultivated crops are grown, further erosion is a severe hazard. It can be controlled by a system of conservation tillage that leaves crop residue on the surface, terraces, and contour farming. If terraces are constructed, cuts should be shallow enough to prevent exposure of the clayey subsoil. Tilth generally is fair in the surface layer. Returning crop residue to the soil or regularly adding other organic material improves fertility and tilth. Because the soil is seepy when wet, measures that help prevent compaction of the surface layer are needed. Also, the soil should not be worked during wet periods.

This soil is moderately suited to grasses and legumes for hay and pasture. Maximum production can be achieved if the pasture or hayland is well managed. Applications of fertilizer, weed and brush control, rotation and deferred grazing, proper stocking rates, and adequate livestock watering facilities help to keep the pasture or hayland in good condition. If the pasture or hayland is tilled, further erosion is a severe hazard. As a result, the grasses and legumes should be interseeded into the existing sod.

This soil is moderately suited to trees. The main management concerns are the windthrow hazard and seedling mortality. The windthrow hazard is caused by a shallow rooting depth. Seedlings do not survive and grow well. As a result, they should be planted at close intervals. Thinning the stand helps to provide adequate growing space for the surviving trees. Woodlots that are used for grazing are subject to compaction and erosion. Grazing also inhibits tree regeneration and causes root damage, which leads to heartrot and other diseases.

The land capability classification is IVe.

793B—Bertrand silt loam, 1 to 5 percent slopes. This gently sloping, well drained soil is on terraces along the major streams and rivers. It is subject to rare flooding. Areas range from 3 to 20 acres in size and are irregularly shaped.

Typically, the surface layer is very dark grayish brown, friable silt loam about 4 inches thick. The subsurface layer is dark grayish brown and brown, friable silt loam about 4 inches thick. The subsoil is about 44 inches thick. It is dark yellowish brown and friable. The upper part is silt loam, the next part is silty clay loam, and the lower part is loam. The substratum to a depth of about 60 inches is dark yellowish brown, stratified loam and sandy loam.

Included with this soil in mapping are a few areas of soils that have sand in the lower part of the subsoil and in the substratum. These soils are droughty in some years of below average rainfall. Typically, they are near the edges of the terraces. They make up less than 5 percent of the unit.

Permeability is moderate in the upper part of the Bertrand soil and moderately rapid in the substratum. Runoff is medium in cultivated areas. Available water capacity is high. The content of organic matter is about 1 to 2 percent in the surface layer. Reaction typically is neutral in the surface soil and medium acid in the subsoil. The subsoil generally has a high supply of available phosphorus and a low supply of available potassium. The surface layer is friable but tends to crust after hard rains and puddle if tilled when wet.

Most areas are cultivated or are used for pasture. Some areas support native hardwoods. This soil is well suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. If cultivated crops are grown, erosion is a hazard. A system of conservation tillage that leaves crop residue on the surface helps to prevent excessive soil loss. Terracing and contour farming are impractical because areas of this soil are small and isolated and because the adjacent soils are nearly level. Good tilth generally can be easily maintained. Returning crop residue to the soil or regularly adding other organic material improves fertility, helps to prevent surface crusting, and increases the rate of water infiltration.

A cover of pasture plants or hay is effective in controlling erosion. Overgrazing or grazing when the soil is too wet, however, causes surface compaction and increases the likelihood of puddling. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and the soil in good condition.

This soil is well suited to trees. No major hazards or limitations affect planting if the proper species are

selected and the stand is managed properly. Woodlots that are used for grazing are subject to compaction and erosion. Grazing also inhibits tree regeneration and causes root damage, which leads to heartrot and other diseases.

The land capability classification is IIe.

795D2—Ashgrove silt loam, 9 to 14 percent slopes, moderately eroded. This strongly sloping, poorly drained soil is on convex and plane side slopes and in coves at the head of upland drainageways. Areas range from 5 to 30 acres in size and are irregularly shaped.

Typically, the surface layer is dark grayish brown, friable silt loam about 7 inches thick. Because of plowing, it has some streaks and pockets of brown silty clay loam subsoil material. The upper part of the subsoil is dark grayish brown and brown, firm silty clay loam; the next part is grayish brown, firm silty clay; and the lower part to a depth of about 60 inches is gray and light brownish gray, mottled, firm clay loam. In places the soil has a surface layer of firm silty clay because of severe erosion.

Permeability is very slow, and runoff is rapid. Available water capacity is high. This soil has a seasonal high water table. The content of organic matter is about 0.5 to 1.0 percent in the surface layer. The shrink-swell potential is high. The subsoil typically is very strongly acid to neutral. It generally has a very low supply of available phosphorus and a low supply of available potassium.

Many areas are used for hay and pasture. Some are used for woodland. A few are cultivated. A few support native hardwoods. This soil is poorly suited to corn, soybeans, and small grain and moderately suited to grasses and legumes for hay and pasture. If cultivated crops are grown, erosion is a very severe hazard and the wetness is a serious limitation. A system of conservation tillage that leaves crop residue on the surface helps to prevent excessive soil loss. Installing interceptor tile in the more permeable soils upslope reduces the wetness in many areas of this soil. Tilth generally is poor or fair in the surface layer. Returning crop residue to the soil or regularly adding other organic material improves fertility and tilth.

A cover of pasture plants or hay is effective in controlling erosion. Proper stocking rates, pasture rotation, and restricted use during wet periods help to keep the pasture and the soil in good condition.

This soil is poorly suited to trees because of the wetness. The main management concerns are the equipment limitation, seedling mortality, and the windthrow hazard. Logging equipment should be used only during the drier periods or during the winter, when the ground is frozen. Because they do not survive well, seedlings should be planted at close intervals. Thinning the stand helps to provide adequate growing space for the surviving trees. The windthrow hazard is caused by the high water table and a shallow rooting depth. Woodlots that are used for grazing are subject to compaction and erosion. Grazing also causes root damage, which leads to heartrot and other diseases.

The land capability classification is IVe.

876B—Ladoga silt loam, benches, 2 to 5 percent slopes. This gently sloping, moderately well drained soil is on high, loess-covered stream benches. Areas are 5 to 15 acres in size and are irregularly shaped.

Typically, the surface layer is very dark brown, friable silt loam about 8 inches thick. The subsoil is silty clay loam about 45 inches thick. The upper part is brown and yellowish brown and is firm, and the lower part is yellowish brown, is mottled with grayish brown, and is friable. The substratum to a depth of about 60 inches is mottled yellowish brown and light brownish gray silty clay loam. Coarse textured material is at a depth of about 5 to 10 feet.

Included with this soil in mapping are small areas of the somewhat poorly drained Givin soils. These soils are on the flatter parts of the landscape slightly below the Ladoga soil. They make up about 5 to 10 percent of the unit.

Permeability is moderately slow in the Ladoga soil, and runoff is medium. Available water capacity is high. The content of organic matter is about 2 to 3 percent in the surface layer. The subsoil typically is strongly acid or medium acid. It generally has a medium supply of available phosphorus and a low supply of available potassium.

Most areas are cultivated or are used for hay and pasture. A few small areas support native hardwoods. This soil is well suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. If row crops are grown, erosion is a hazard. A system of conservation tillage that leaves crop residue on the surface, contour farming, and terraces help to prevent excessive soil loss. Grassed waterways help to prevent gullying. Good tilth generally can be easily maintained. Returning crop residue to the soil or regularly adding other organic material improves fertility and helps to prevent deterioration of tilth.

A cover of pasture plants or hay is effective in controlling erosion. Overgrazing, however, causes surface compaction, increases the runoff rate, and causes deterioration of tilth and thus reduces the extent of the protective plant cover. Proper stocking rates, pasture rotation, and timely deferment of grazing help to keep the pasture and the soil in good condition.

This soil is well suited to trees. No major hazards or limitations affect planting if the proper species are selected. Woodlots that are used for grazing are subject to compaction and erosion. Grazing also causes root damage, which leads to heartrot and other diseases.

The land capability classification is IIe.

876C2—Ladoga silt loam, benches, 5 to 9 percent slopes, moderately eroded. This moderately sloping, moderately well drained soil is on plane and convex side slopes on high, loess-covered stream benches. Areas are 5 to 15 acres in size and are irregularly shaped.

Typically, the surface layer is very dark brown, friable silt loam about 8 inches thick. Because of plowing, it has some streaks and pockets of brown silty clay loam subsoil material. The subsoil is silty clay loam about 38 inches thick. The upper part is brown and yellowish brown and is firm, and the lower part is yellowish brown, is mottled with grayish brown, and is friable. The substratum to a depth of about 60 inches is yellowish brown and light brownish gray silty clay loam. Coarse textured material is at a depth of about 5 to 10 feet. In places the surface layer is mixed dark brown and brown silty clay loam and contains less organic matter because of severe erosion.

Permeability is moderately slow, and runoff is medium. Available water capacity is high. The content of organic matter is about 0.5 to 1.5 percent in the surface layer. The subsoil typically is medium acid or strongly acid. It generally has a medium supply of available phosphorus and a low supply of available potassium.

Most areas are cultivated or are used for hay and pasture. A few small areas support native hardwoods. This soil is moderately suited to corn, soybeans, and small grain. It is well suited to hay and pasture. If row crops are grown, further erosion is a hazard. A system of conservation tillage that leaves crop residue on the surface, contour farming, and terraces help to prevent excessive soil loss. Grassed waterways help to prevent gullying. Tilth generally is fair. Returning crop residue to the soil or regularly adding other organic material improves fertility and tilth.

A cover of pasture plants or hay is effective in controlling erosion. Overgrazing, however, causes surface compaction and poor tilth, increases the runoff rate, and reduces forage production. Proper stocking rates, pasture rotation, and timely deferment of grazing, especially during wet periods, help to keep the pasture and the soil in good condition.

This soil is well suited to trees. No major hazards or limitations affect planting if the proper species are selected. If not properly managed, woodlots that are used for grazing are subject to compaction and erosion. Grazing also inhibits tree regeneration and causes root damage, which leads to heartrot and other diseases.

The land capability classification is IIIe.

880B—Clinton silt loam, benches, 2 to 5 percent slopes. This gently sloping, moderately well drained soil is on high, loess-covered stream benches. Areas are 5 to 15 acres in size and are irregularly shaped.

Typically, the surface layer is very dark gray, friable silt loam about 3 inches thick. The subsurface layer is dark grayish brown, friable silt loam about 6 inches thick. The subsoil to a depth of about 60 inches is yellowish brown silty clay loam. The upper part is firm, and the lower part is friable and is mottled with grayish brown. Coarse textured material is at a depth of about 5 to 10 feet.

Included with this soil in mapping are areas of the somewhat poorly drained Keomah soils. These soils are on the flatter parts of the landscape slightly below the Clinton soil. They make up 5 to 10 percent of the unit.

Permeability is moderately slow in the Clinton soil, and runoff is medium. Available water capacity is high. The content of organic matter is about 1.5 to 2.5 percent in the surface layer. The subsoil typically is strongly acid or medium acid. It generally has a high supply of available phosphorus and a low supply of available potassium.

Most areas are cultivated or are used for hay and pasture (fig. 8). A few small areas support native hardwoods. This soil is well suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. If row crops are grown, erosion is a hazard. A system of conservation tillage that leaves crop residue on the surface, contour farming, and terraces help to prevent excessive soil loss. Grassed waterways help to prevent gullying. Good tilth generally can be easily maintained. Returning crop residue to the soil or regularly adding other organic material improves fertility and helps to maintain good tilth.

A cover of pasture plants or hay is effective in controlling erosion. Overgrazing, however, causes surface compaction, increases the runoff rate, and causes deterioration of tilth and thus reduces the extent of the protective plant cover. Proper stocking rates, pasture rotation, and timely deferment of grazing help to keep the pasture and the soil in good condition.

This soil is well suited to trees. No major hazards or limitations affect planting if the proper species are selected and the stand is managed properly.

The land capability classification is IIe.

880C2—Clinton silt loam, benches, 5 to 9 percent slopes, moderately eroded. This moderately sloping, moderately well drained soil is on plane and convex side slopes on high, loess-covered stream benches. Areas are 5 to 15 acres in size and are irregularly shaped.

Typically, the surface layer is dark grayish brown and brown, friable silt loam about 8 inches thick. Because of plowing, it has some streaks and pockets of yellowish brown silty clay loam subsoil material. The subsoil to a depth of about 60 inches is yellowish brown silty clay loam. The upper part is firm, and the lower part is friable and is mottled with grayish brown. In places the surface layer is mixed brown and yellowish brown silty clay loam and contains less organic matter because of severe erosion. Coarse textured material is at a depth of about 5 to 10 feet.

Permeability is moderately slow, and runoff is medium. Available water capacity is high. The content of organic matter is about 0.5 to 1.0 percent in the surface layer.

Figure 8.—A pastured area of Clinton silt loam, benches, 2 to 5 percent slopes.

Reaction typically is slightly acid in the surface layer and medium acid or strongly acid in the subsoil. The subsoil generally has a high supply of available phosphorus and a low supply of available potassium.

Most areas are cultivated or are used for hay and pasture. A few small areas support native hardwoods. This soil is moderately suited to corn, soybeans, and small grain. It is well suited to hay and pasture. If row crops are grown, further erosion is a hazard. A system of conservation tillage that leaves crop residue on the surface, contour farming, and terraces help to prevent excessive soil loss. Grassed waterways help to prevent gullying. Tilth generally is fair. Returning crop residue to the soil or regularly adding other organic material improves fertility and tilth.

A cover of pasture plants or hay is effective in controlling erosion. Overgrazing, however, causes surface compaction and poor tilth, increases the runoff rate, and reduces forage production. Proper stocking rates, pasture rotation, and timely deferment of grazing, especially during wet periods, help to keep the pasture and the soil in good condition.

This soil is well suited to trees. No major hazards or limitations affect planting if the proper species are selected. If not properly managed, woodlots that are used for grazing are subject to compaction and erosion. Grazing also inhibits tree regeneration and causes root damage, which leads to heartrot and other diseases.

The land capability classification is IIIe.

880D2—Clinton silt loam, benches, 9 to 14 percent slopes, moderately eroded. This strongly sloping, moderately well drained soil is on short side slopes on high, loess-covered stream benches. Areas range from 3 to 15 acres in size and are irregularly shaped.

Typically, the surface layer is dark grayish brown and brown, friable silt loam about 8 inches thick. Because of plowing, it has some streaks and pockets of yellowish brown silty clay loam subsoil material. The subsoil is yellowish brown silty clay loam about 48 inches thick. The upper part is firm, and the lower part is friable and is mottled with grayish brown. The substratum to a depth of about 60 inches is mottled yellowish brown and grayish brown silt loam. Coarse textured material is at a depth of about 5 to 10 feet. In places the surface layer is mixed brown and yellowish brown silty clay loam and contains less organic matter because of severe erosion.

Included with this soil in mapping are small areas of Douds and Galland soils. These soils are in positions on the landscape similar to those of the Clinton soil. Douds soils are loamy in the upper part and sandy in the substratum. Galland soils are slowly permeable and are more clayey in the subsoil than the Clinton soil. As a result, the lower adjacent areas tend to be seepy during wet periods. Included soils make up 2 to 5 percent of the unit.

Permeability is moderately slow in the Clinton soil, and runoff is rapid. Available water capacity is high. The content of organic matter is less than 0.5 percent in the surface layer. Reaction typically is slightly acid in the surface layer and strongly acid or medium acid in the subsoil. The subsoil generally has a high supply of available phosphorus and a low supply of available potassium.

Most areas are cultivated or are used for hay and pasture. A few small areas support native hardwoods. This soil is moderately suited to corn, soybeans, and small grain and is well suited to hay and pasture. If row crops are grown, further erosion is a severe hazard. A system of conservation tillage that leaves crop residue on the surface, contour farming, and terraces help to prevent excessive soil loss. Grassed waterways help to prevent gullying. Tilth generally is fair. Returning crop residue to the soil or regularly adding other organic material improves fertility and tilth.

A cover of pasture plants or hay is effective in controlling erosion. Overgrazing, however, causes surface compaction and poor tilth, increases the runoff rate, and reduces forage production. Proper stocking rates, pasture rotation, and timely deferment of grazing, especially during wet periods, help to keep the pasture and the soil in good condition.

This soil is well suited to trees. No major hazards or limitations affect planting if the proper species are selected. Woodlots that are used for grazing are subject to compaction and erosion if they are not managed properly. Grazing also inhibits tree regeneration and causes root damage, which leads to heartrot and other diseases.

The land capability classification is IIIe.

881B—Otley silty clay loam, benches, 2 to 5 percent slopes. This gently sloping, moderately well drained soil is on high, loess-covered stream benches. Areas range from 5 to 25 acres in size and are irregularly shaped.

Typically, the surface layer is very dark brown and black, friable silty clay loam about 8 inches thick. The subsurface layer is black and very dark grayish brown, friable silty clay loam about 10 inches thick. The subsoil to a depth of about 60 inches is firm silty clay loam. The upper part is brown, the next part is brown and mottled, and the lower part is mottled yellowish brown, light brownish gray, and strong brown. Coarse textured material is at a depth of about 5 to 10 feet.

Included with this soil in mapping are small areas of the somewhat poorly drained Mahaska soils. These soils are on the flatter parts of the landscape slightly below the Otley soil. They make up about 5 to 10 percent of the unit.

Permeability is moderate in the Otley soil, and runoff is medium. Available water capacity is high. The content of organic matter typically is about 3 to 4 percent in the surface layer. The subsoil typically is strongly acid or medium acid. It generally has a low supply of available phosphorus and a very low supply of available potassium.

Most areas are cultivated or are used for hay and pasture. This soil is well suited to corn, soybeans, and small grain. If cultivated crops are grown, erosion is a hazard. A system of conservation tillage that leaves crop residue on the surface, contour farming, and terraces help to prevent excessive soil loss. Grassed waterways help to prevent gullying. Good tilth generally can be easily maintained. Returning crop residue to the soil or regularly adding other organic material improves fertility and helps to prevent deterioration of tilth.

This soil is well suited to grasses and legumes for hay and pasture. Maximum production can be achieved if good management is applied. Applications of fertilizer, weed and brush control, rotation and deferred grazing, proper stocking rates, and adequate livestock watering facilities help to keep the pasture or hayland in good condition. If the pasture or hayland is tilled, erosion is a moderate hazard. As a result, the grasses and legumes should be interseeded into the existing sod.

The land capability classification is IIe.

993D2—Gara-Armstrong complex, 9 to 14 percent slopes, moderately eroded. These strongly sloping soils are on upland side slopes. The well drained Gara soil is on the lower part of the side slopes, and the somewhat poorly drained Armstrong soil is on the upper part. Areas range from 5 to 50 acres in size and are irregularly shaped. They are about 55 percent Gara soil and 35 percent Armstrong soil. The two soils occur as areas so intricately mixed or so small that mapping them separately is impractical.

Typically, the surface layer of the Gara soil is very dark grayish brown, friable loam about 8 inches thick. Because of plowing, it has some streaks and pockets of brown subsoil material. The subsoil is about 43 inches thick. The upper part is brown, friable loam; the next part is yellowish brown, firm clay loam; and the lower part is yellowish brown, mottled firm clay loam. The substratum to a depth of about 60 inches is yellowish brown, mottled clay loam. In places the surface layer is brown, firm clay loam and is lower in content of organic matter because of severe erosion.

Typically, the surface layer of the Armstrong soil is dark brown, friable silt loam about 8 inches thick. Because of plowing, it has some streaks and pockets of brown and yellowish red clay loam subsoil material. The subsoil extends to a depth of about 60 inches. It is firm. The upper part is yellowish red, firm clay loam; the next part is brown and strong brown, firm clay and clay loam mottled with red and dark red; and the lower part is strong brown and yellowish brown, firm clay loam mottled with grayish brown. In places the surface layer is brown and yellowish red, firm clay loam and is lower in content of organic matter because of severe erosion.

Included with these soils in mapping are small areas of Ladoga soils. These included soils are silty throughout. They are higher on the landscape than the Gara and Armstrong soils. They make up less than 10 percent of the unit.

Permeability is moderately slow or slow in the Gara and Armstrong soils, and runoff is rapid. Available water capacity is high. The Armstrong soil has a seasonal high water table. The content of organic matter is about 0.5 to 1.5 percent in the surface layer of both soils. The shrink-swell potential is high in the Armstrong soil. Reaction typically is medium acid to very strongly acid in the subsoil of both soils. The subsoil of the Gara soil generally has a low supply of available phosphorus and a very low supply of available potassium. The subsoil of the Armstrong soil generally has a very low supply of available phosphorus and potassium.

Most areas are cultivated. Some large areas are used for hay and pasture. A few areas support native hardwoods. In most areas these soils are managed along with the adjacent soils. They are poorly suited to corn, soybeans, and small grain. If cultivated crops are grown, further erosion is a hazard. It can be controlled, however, by contour farming, terraces, a system of conservation tillage that leaves crop residue on the surface, and crop rotations that include meadow crops. Terrace cuts should be shallow enough to prevent exposure of the clayey subsoil.

Tilth generally is fair in these soils. Returning crop residue to the soil or regularly adding other organic material helps to maintain or improve tilth and fertility, helps to prevent surface crusting, and increases the rate of water infiltration. Because the soils are seepy when wet, measures that help to prevent compaction of the surface layer are needed. Also, the soils should not be worked during wet periods.

These soils are moderately suited to grasses and legumes for hay and pasture. A cover of pasture plants or hay is effective in controlling erosion. Overgrazing, however, causes surface compaction and poor tilth, increases the runoff rate, and reduces forage production. Proper stocking rates, pasture rotation, and timely deferment of grazing, especially during wet periods, help to keep the pasture and the soils in good condition.

These soils are moderately well suited to trees. Seedlings do not survive and grow well, especially on the Armstrong soil. As a result, they should be spaced close together. Thinning the stand helps to provide adequate growing space for the surviving trees. Windthrow is a hazard on the Armstrong soil because of a shallow rooting depth. Woodlots that are used for grazing are subject to compaction and erosion. Grazing also inhibits tree regeneration and causes root damage, which leads to heartrot and other diseases.

The land capability classification is IVe.

993D3—Gara-Armstrong clay loams, 9 to 14 percent slopes, severely eroded. These strongly sloping soils are on upland side slopes. The well drained Gara soil is on the lower part of the side slopes, and the somewhat poorly drained Armstrong soil is on the upper part. Areas range from 5 to 25 acres in size and are irregularly shaped. They are about 55 percent Gara soil and 35 percent Armstrong soil. The two soils occur as areas so intricately mixed or so small that mapping them separately is impractical.

Typically, the surface layer of the Gara soil is brown, firm clay loam about 7 inches thick. Streaks and pockets of very dark grayish brown loam make up 10 to 15 percent of this layer. The subsoil is firm clay loam about 33 inches thick. The upper part is brown and yellowish brown, and the lower part is yellowish brown and mottled. The substratum to a depth of about 60 inches is yellowish brown, mottled clay loam. In places the soil is calcareous.

Typically, the surface layer of the Armstrong soil is brown and yellowish red, firm clay loam about 7 inches thick. Streaks and pockets of dark brown silt loam make up 10 to 15 percent of this layer. The subsoil is about 43 inches thick. It is firm. The upper part is yellowish red clay loam, the next part is brown and strong brown clay and clay loam mottled with red and dark red, and the lower part is strong brown and yellowish brown clay loam mottled with grayish brown. The substratum to a depth of about 60 inches is yellowish brown, mottled clay loam.

Included with these soils in mapping are small areas of Ladoga soils. These included soils are silty throughout. They are higher on the landscape than the Gara and Armstrong soils. They make up less than 10 percent of the unit.

Permeability is moderately slow or slow in the Gara and Armstrong soils, and runoff is rapid. Available water capacity is high. The Armstrong soil has a seasonal high water table. The content of organic matter is less than 0.5 percent in the surface layer of both soils. The shrink-swell potential is high in the Armstrong soil. Reaction typically is medium acid to very strongly acid in the subsoil of both soils. The subsoil of the Gara soil generally has a low supply of available phosphorus and a very low supply of available potassium. The subsoil of

the Armstrong soil generally has a very low supply of available phosphorus and potassium.

Some areas are cultivated. Almost all areas have been cultivated in the past. Many are now used for hay and pasture. In most areas these soils are managed along with the adjacent soils. Because of the slope and a severe erosion hazard, they generally are unsuited to cultivated crops. They are poorly suited to grasses and legumes for hay and pasture. The surface layer tends to seal and crust when worked. As a result, the rate of water infiltration is reduced and the runoff rate is increased. The increased runoff rate accelerates sheet and gully erosion.

A cover of pasture plants or hay is effective in controlling erosion. Overgrazing, however, causes surface compaction, increases the runoff rate, and reduces forage production. Proper stocking rates, pasture rotation, and timely deferment of grazing, especially during wet periods, help to keep the pasture and the soils in good condition.

These soils are moderately suited to trees. Seedlings do not survive and grow well, especially on the Armstrong soil. As a result, they should be spaced close together. Thinning the stand helps to provide adequate growing space for the surviving trees. Because of the content of clay in the surface layer, operating equipment may be difficult when the soils are wet. Windthrow is a hazard on the Armstrong soil because of a shallow rooting depth. Woodlots that are used for grazing are subject to compaction and erosion. Grazing also inhibits tree regeneration and causes root damage, which leads to heartrot and other diseases.

The land capability classification is VIe.

993E2—Gara-Armstrong complex, 14 to 18 percent slopes, moderately eroded. These moderately steep soils are on upland side slopes. The well drained Gara soil is on the lower part of the side slopes, and the somewhat poorly drained Armstrong soil is on the upper part. Areas range from 5 to 20 acres in size and are irregularly shaped. They are about 55 percent Gara soil and 35 percent Armstrong soil. The two soils occur as areas so intricately mixed or so small that mapping them separately is impractical.

Typically, the surface layer of the Gara soil is very dark grayish brown, friable loam about 8 inches thick. Because of plowing, it has some streaks and pockets of brown subsoil material. The subsoil is about 40 inches thick. The upper part is brown, friable loam; the next part is yellowish brown, firm clay loam; and the lower part is yellowish brown, mottled firm clay loam. The substratum to a depth of about 60 inches is yellowish brown, mottled clay loam. In places the surface layer is brown, firm clay loam and is lower in content of organic matter because of severe erosion.

Typically, the surface layer of the Armstrong soil is dark brown, friable silt loam about 8 inches thick. Because of plowing, it has some streaks and pockets of brown and yellowish red clay loam subsoil material. The subsoil is about 49 inches thick. It is firm. The upper part is yellowish red clay loam, the next part is brown and strong brown clay and clay loam mottled with red and dark red, and the lower part is strong brown and yellowish brown clay loam mottled with grayish brown. The substratum to a depth of about 60 inches is yellowish brown, mottled clay loam. In places the surface layer is brown and yellowish red, firm clay loam and is lower in content of organic matter because of severe erosion.

Included with these soils in mapping are small areas of Ladoga soils. These included soils are silty throughout. They are higher on the landscape than the Gara and Armstrong soils. They make up less than 10 percent of the unit.

Permeability is slow or moderately slow in the Gara and Armstrong soils, and runoff is rapid. Available water capacity is high. The Armstrong soil has a seasonal high water table. The content of organic matter is about 0.5 to 1.5 percent in the surface layer of both soils. The shrink-swell potential is high in the Armstrong soil. Reaction typically is medium acid to very strongly acid in the subsoil of both soils. The subsoil of the Gara soil generally has a low supply of available phosphorus and a very low supply of available potassium. The subsoil of the Armstrong soil generally has a very low supply of available phosphorus and potassium.

Most areas are used for hay and pasture. Some are cultivated. A few are wooded. Because of the slope and a severe hazard of erosion, these soils generally are unsuited to cultivated crops. They are moderately suited to grasses and legumes for hay and pasture. Tilth generally is fair in the surface layer. A cover of pasture plants or hay is effective in controlling erosion. Overgrazing, however, causes surface compaction and poor tilth, increases the rate of runoff, and reduces forage production. Proper stocking rates, pasture rotation, and timely deferment of grazing, especially during wet periods, help to keep the pasture and the soils in good condition.

These soils are moderately suited to trees. Erosion, the equipment limitation, the windthrow hazard, and seedling mortality are management concerns. Carefully selecting sites for logging trails or roads and laying out the trails or roads on the contour help to control erosion. Because of the slope, special logging equipment may be needed. Also, caution is needed when this equipment is operated. Because they do not survive well, seedlings should be planted at close intervals. Thinning the stand helps to provide adequate growing space for the surviving trees. The windthrow hazard results from a shallow rooting depth in the Armstrong soil. Woodlots that are used for grazing are subject to compaction and erosion. Grazing also inhibits tree regeneration and

causes root damage, which leads to heartrot and other diseases.

The land capability classification is VIe.

994D3—Galland-Douds clay loams, 9 to 14 percent slopes, severely eroded. These strongly sloping soils are on the sides of high benches that border valleys along the major streams and their tributaries. The somewhat poorly drained Galland soil is on the upper part of the side slopes, and the moderately well drained Douds soil is on the lower part. Areas range from 5 to 30 acres in size and are irregularly shaped. They are about 50 percent Galland soil and 40 percent Douds soil. The two soils occur as areas so intricately mixed or so small that mapping them separately is impractical.

Typically, the surface layer of the Galland soil is yellowish brown, firm clay loam about 6 inches thick. Streaks and pockets of dark grayish brown loam make up 10 to 15 percent of this layer. The subsoil is about 44 inches thick. The upper part is reddish brown and strong brown, firm clay loam; the next part is strong brown and yellowish red, friable clay loam mottled with grayish brown; and the lower part is strong brown and brown, friable, stratified sandy loam and sandy clay loam mottled with grayish brown. The substratum to a depth of about 60 inches is strong brown sandy loam.

Typically, the surface layer of the Douds soil is yellowish brown, friable clay loam about 6 inches thick. Streaks and pockets of dark grayish brown loam make up 10 to 15 percent of this layer. The subsoil extends to a depth of about 60 inches. In sequence downward, it is yellowish brown and brown, friable loam and clay loam; yellowish brown and strong brown, friable clay loam; strong brown, firm clay loam; and strong brown, friable, stratified clay loam, sandy clay loam, and sandy loam mottled with light yellowish brown and reddish brown.

Included with these soils in mapping are small areas of Clinton and Nordness soils. Clinton soils formed in loess and do not have coarse textured material. They make up about 5 to 10 percent of the unit. Nordness soils are shallow to limestone or sandstone. They are generally at the base of the side slopes. They make up less than 2 percent of the unit.

Permeability is slow in the Galland soil and moderate in the Douds soil. Runoff is rapid on both soils. Available water capacity is high in the Galland soil and moderate in the Douds soil. Both soils have a seasonal high water table. The content of organic matter is less than 0.5 percent in the surface layer. The shrink-swell potential is high in the Galland soil. Reaction is medium acid to very strongly acid in the upper part of the subsoil in both soils. The subsoil generally has a very low supply of available phosphorus and potassium.

Most areas are used for hay and pasture or are cultivated. A few are wooded. These soils generally are unsuited to corn, soybeans, and small grain and are moderately suited to hay and pasture. If cultivated crops are grown, further erosion is a severe hazard. The surface layer tends to seal and crust when worked. As a result, the rate of water infiltration is reduced and the runoff rate is increased. The increased runoff rate accelerates sheet and gully erosion.

A cover of pasture plants or hay is effective in controlling erosion. Overgrazing or grazing when the soil is too wet, however, causes surface compaction and poor tilth, increases the runoff rate, and reduces forage production. Proper stocking rates, pasture rotation, and timely deferment of grazing help to keep the pasture and the soil in good condition.

These soils are moderately suited to trees. Windthrow is a hazard on the Galland soil because of a shallow rooting depth. Seedling mortality also is a problem. Seedlings do not survive and grow well. As a result, they should be spaced close together. Thinning the stand helps to provide adequate growing space for the surviving trees. Woodlots that are used for grazing are subject to compaction and erosion. Grazing also inhibits tree regeneration and causes root damage, which leads to heartrot and other diseases.

The land capability classification is VIe.

1075—Givin silt loam, benches, 1 to 3 percent slopes. This very gently sloping, somewhat poorly drained soil is on small flats on high, loess-covered stream benches. In places it is subject to the runoff from adjacent upland slopes. Areas range from 2 to 15 acres in size and are irregularly shaped.

Typically, the surface layer is very dark gray, friable silt loam about 7 inches thick. The subsurface layer is grayish brown, friable silt loam about 6 inches thick. The subsoil extends to a depth of about 60 inches. It is mottled with yellowish brown. The upper part is brown and grayish brown, firm silty clay; the next part is grayish brown, firm silty clay loam; and the lower part is grayish brown, friable silty clay loam. Coarse textured material is at a depth of 5 to 10 feet. In places the soil is more sloping.

Included with this soil in mapping are small areas of the poorly drained Rubio soils. These soils are in slight depressions. They make up about 5 to 10 percent of the unit.

Permeability is moderately slow in the Givin soil, and runoff is medium. Available water capacity is high. This soil has a seasonal high water table. The content of organic matter is about 2 to 3 percent in the surface layer. The subsoil typically is medium acid or strongly acid. It generally has a medium supply of available phosphorus and a low supply of available potassium.

Most areas are cultivated. Some are used for hay and pasture. A few small areas support native hardwoods. This soil is well suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. If cultivated crops are grown, erosion is a hazard. A system of conservation tillage that leaves crop residue

on the surface, contour farming, and terraces help to prevent excessive soil loss. In many places, however, contour farming or terracing is difficult because of irregular slopes. In some areas diversion terraces help to prevent excessive runoff from the adjacent upland slopes. Most areas are adequately drained. In some areas, however, tile drains are needed to improve the timeliness of fieldwork in wet years. They function satisfactorily if suitable outlets are available. Good tilth generally can be easily maintained. Returning crop residue to the soil and delaying fieldwork when the soil is wet help to prevent deterioration of tilth and improve fertility.

A cover of pasture plants or hay is effective in controlling erosion. Overgrazing or grazing when the soil is wet, however, causes some surface compaction and deterioration of tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and the soil in good condition.

This soil is well suited to trees. Seedlings survive and grow well. Woodlots that are used for grazing are subject to compaction. Grazing also inhibits tree regeneration and causes root damage, which leads to heartrot and other diseases.

The land capability classification is IIe.

1180—Keomah silt loam, benches, 1 to 3 percent slopes. This very gently sloping, somewhat poorly drained soil is on small flats on high, loess-covered stream benches. In places it is subject to the runoff from adjacent upland slopes. Areas range from 2 to 15 acres in size and are irregularly shaped.

Typically, the surface layer is dark gray, friable silt loam about 7 inches thick. The subsurface layer is dark gray, grayish brown, and dark grayish brown, friable silt loam about 5 inches thick. The subsoil is about 35 inches thick. The upper part is brown, friable silty clay and silty clay loam; the next part is brown and grayish brown, firm silty clay mottled with strong brown; and the lower part is grayish brown and brown, friable silty clay loam. The substratum to a depth of about 60 inches is olive gray silty clay loam. Coarse textured material is at a depth of 5 to 10 feet. In places the soil is more sloping.

Included with this soil in mapping are areas of soils that are on the more nearly level or slightly depressional parts of the landscape. These soils are wetter than the Keomah soil. Also, they have a grayer subsoil that contains more clay. They make up about 5 to 10 percent of the unit.

Permeability is slow in the Keomah soil, and runoff is medium. Available water capacity is high. This soil has a seasonal high water table. The content of organic matter is about 1 to 2 percent in the surface layer. The shrink-swell potential is high. The subsoil typically is medium acid to very strongly acid. It generally has a medium supply of available phosphorus and a very low supply of available potassium.

Most areas are cultivated. A few support native hardwoods. This soil is well suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. If cultivated crops are grown, erosion is a hazard. A system of conservation tillage that leaves crop residue on the surface, contour farming, and terraces help to prevent excessive soil loss. In many places, however, contour farming or terracing is difficult because of irregular slopes. In some areas diversion terraces help to prevent excessive runoff from the adjacent upland slopes. A drainage system is needed to reduce the wetness of some cultivated areas. Good tilth generally can be easily maintained. Returning crop residue to the soil or regularly adding other organic material improves fertility, helps to prevent surface crusting and deterioration of tilth, and increases the rate of water infiltration.

A cover of pasture plants or hay is effective in controlling erosion. Overgrazing or grazing during wet periods, however, reduces the extent of the plant cover and causes surface compaction and deterioration of tilth.

This soil is well suited to trees. Woodlots that are used for grazing are subject to compaction and erosion. Grazing also inhibits tree regeneration and causes root damage, which leads to heartrot and other diseases.

The land capability classification is IIe.

1280—Mahaska silty clay loam, benches, 1 to 3 percent slopes. This very gently sloping, somewhat poorly drained soil is on small flats on high, loess-covered stream benches. In places it is subject to the runoff from adjacent upland slopes. Areas range from 2 to 25 acres in size and are irregularly shaped.

Typically, the surface layer is black, friable silty clay loam about 8 inches thick. The subsurface layer is black and very dark grayish brown, firm silty clay loam about 9 inches thick. The subsoil to a depth of about 60 inches is firm silty clay loam. The upper part is dark grayish brown and light olive brown, the next part is light olive gray and mottled, and the lower part is gray and mottled. Coarse textured material is at a depth of 5 to 10 feet. In some places the soil is more sloping. In other places it has a silt loam surface layer.

Included with this soil in mapping are some areas of the very poorly drained Sperry and poorly drained Taintor soils on the small flats. These soils make up less than 10 percent of the unit.

Permeability is moderate in the Mahaska soil, and runoff is medium. Available water capacity is high. This soil has a seasonal high water table. The content of organic matter is about 5 to 6 percent in the surface layer. The subsoil typically is medium acid to very strongly acid. It generally has a medium supply of available phosphorus and a low supply of available potassium.

Most areas are cultivated. This soil is well suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. If cultivated crops are grown, erosion is a hazard. A system of conservation tillage that leaves crop residue on the surface, contour farming, and terraces help to prevent excessive soil loss. In many places, however, contour farming or terracing is difficult because of irregular slopes. In some areas diversion terraces help to prevent excessive runoff from the adjacent upland slopes. Row crops can be grown in most years. Most areas are adequately drained. In some areas, however, tile drains are needed to improve the timeliness of fieldwork in wet years. Good tilth generally can be easily maintained. Returning crop residue to the soil and delaying fieldwork when the soil is wet help to prevent deterioration of tilth.

A cover of pasture plants or hay is effective in controlling erosion. Overgrazing or grazing when the soil is wet, however, causes surface compaction and poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and the soil in good condition.

The land capability classification is IIe.

1354—Aquents, ponded. These nearly level, very poorly drained soils occur as recently deposited, stratified sediments in old oxbows or channels adjacent to the major streams and rivers. They are frequently flooded and are ponded most of the year unless they are drained. Areas range from 2 to 20 acres in size and are crescent shaped.

Typically, the surface layer is stratified very dark grayish brown, grayish brown, and very dark gray silt loam about 10 inches thick. The substratum to a depth of about 60 inches is stratified very dark gray, dark grayish brown, and very dark grayish brown silty clay loam. It is mottled with red in the lower part. In places the texture is silt loam to a depth of 60 inches.

Included with these soils in mapping are areas of soils that have strata of sand. These included soils are more permeable than the Aquents. Also included are areas of Zook soils, which are not stratified, are silty clay or silty clay loam throughout, and are more slowly permeable than the Aquents. Included soils make up about 15 percent of the unit.

Permeability varies in the Aquents but generally is moderate, moderately slow, or slow. Runoff is ponded. The content of organic matter ranges from 2 to 10 percent. Reaction generally is medium acid to neutral.

Most of the acreage is idle land. A few areas have been drained and are used for cultivated crops. These soils generally are unsuited to cultivated crops, pasture, and hay. They are best suited to wetland wildlife habitat.

The land capability classification is Vw.

1484—Lawson silt loam, channeled, 0 to 2 percent slopes. This nearly level, somewhat poorly drained soil is on flood plains dissected by meandering streams and oxbows. It is frequently flooded. Areas range from 20 to more than 100 acres in size and are irregularly shaped.

Typically, the surface layer is very dark grayish brown, friable silt loam about 13 inches thick. The subsurface layer is friable silt loam about 30 inches thick. The upper part is black and very dark gray, and the lower part is dark grayish brown. The substratum to a depth of about 60 inches is mottled grayish brown, gray, and light brownish gray silt loam. In places strata of sand are throughout the surface soil.

Included with this soil in mapping are areas of Aquents, ponded, and areas of Colo soils. These included soils are in the old channels and oxbows. They make up about 15 percent of the unit. The Aquents are ponded throughout most of the year. Colo soils are higher in content of clay than the Lawson soil and are poorly drained.

Permeability is moderate in the Lawson soil, and runoff is slow. Available water capacity is very high. This soil has a seasonal high water table. The content of organic matter is about 4.5 to 6.0 percent in the surface layer. The subsurface layer typically is neutral or slightly acid. It generally has a medium supply of available phosphorus and a low supply of available potassium.

Most areas are used for permanent pasture or woodland. A few areas between the old channels are cultivated. Because of the flooding and the numerous old stream channels and oxbows, this soil generally is unsuited to cultivated crops and hay. It is moderately suited to pasture. Trees should be removed, channels straightened or filled, levees built, and drainage ditches dug before the soil is cropped. Measures that protect pastures and trees from floodwater also are needed.

This soil generally is suited to habitat for different types of wildlife. These include wetland wildlife, which flourish in the ponded areas in the old channels and oxbows.

The land capability classification is Vw.

2226—Elrin loam, 0 to 2 percent slopes. This nearly level, somewhat poorly drained soil is on terraces along the major rivers. It is subject to rare flooding. Areas range from 10 to 50 acres in size and are irregularly shaped.

Typically, the surface layer is black and very dark brown, friable loam about 7 inches thick. The subsurface layer is very dark brown, black, very dark grayish brown, and dark grayish brown, friable loam about 8 inches thick. The subsoil is about 39 inches thick. The upper part is dark grayish brown, friable loam mottled with brown; the next part is grayish brown and brown, mottled, friable sandy loam; and the lower part is yellowish brown and brown, mottled, very friable loamy

sand and sand. The substratum to a depth of about 60 inches is brown, loose sand.

Permeability is moderate in the upper part of the profile and rapid in the lower part. Runoff is slow. Available water capacity is moderate. This soil has a seasonal high water table. The content of organic matter is about 2 to 3 percent in the surface layer. The subsoil typically is strongly acid or medium acid. It generally has a very low supply of available phosphorus and potassium.

Most areas are cultivated. This soil is well suited to corn, soybeans, and small grain and is suited to grasses and legumes for hay and pasture. It can be cropped intensively. During some hot, dry periods, however, it is slightly droughty because of the moderate available water capacity. Also, wind erosion is a hazard. A system of conservation tillage that leaves crop residue on the surface conserves moisture and helps to control wind erosion. Good tilth generally can be easily maintained.

If this soil is used for pasture, wind erosion is a hazard during extended hot, dry periods, when the extent of the protective plant cover is reduced. Proper stocking rates, pasture rotation, and deferment of grazing during the extended dry periods help to keep the pasture in good condition.

The land capability classification is IIs.

2242—Nodaway-Amana silt loams, 0 to 2 percent slopes. These nearly level, moderately well drained and somewhat poorly drained soils are on flood plains along the English, Skunk, and Iowa Rivers. The Amana soil is on slight rises above the Nodaway soil. Both soils are frequently flooded. Areas range from 40 to several hundred acres in size and are elongated and irregularly shaped. They are about 50 percent Nodaway soil and 40 percent Amana soil. The two soils occur as areas so intricately mixed or so small that mapping them separately is impractical.

Typically, the surface layer of the Nodaway soil is very dark grayish brown, friable silt loam about 8 inches thick. The substratum to a depth of about 60 inches is stratified very dark gray, dark grayish brown, and grayish brown silt loam. In places the surface layer is sand.

Typically, the surface layer of the Amana soil is black, friable silt loam about 10 inches thick. The subsurface layer is very dark gray, friable silt loam about 6 inches thick. The subsoil is friable silt loam about 32 inches thick. The upper part is dark grayish brown and grayish brown, and the lower part is grayish brown and mottled. The substratum to a depth of about 60 inches is grayish brown and dark grayish brown silt loam.

Included with these soils in mapping are small areas of Aquents, ponded, and small areas of Colo soils. These included soils are in old oxbows and channels below the Nodaway and Amana soils. Aquents occur as alluvial sediments deposited by frequently flooding streams and rivers. Colo soils have a thick, black silty clay loam surface layer over a gray subsoil and are poorly drained. Aquents make up about 2 percent of the unit and Colo soils about 8 percent.

Permeability is moderate in the Nodaway and Amana soils, and runoff is slow. Available water capacity is high or very high. Both soils have a seasonal high water table. The content of organic matter is about 2 to 5 percent in the surface layer. The subsoil of the Amana soil and the substratum of the Nodaway soil are neutral to strongly acid. They generally have a medium supply of available phosphorus and a very low supply of available potassium.

Many areas are cultivated. Many are wooded. A few are used for hay and pasture. These soils are moderately suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. Because of flooding in spring, planting is normally delayed. Occasional flooding after planting can severely damage crops in some years. Properly located levees generally can reduce the susceptibility to flooding. The wetness caused by the flooding and the seasonal high water table is a limitation. Measures that reduce the wetness improve the timeliness of fieldwork. Good tilth generally can be easily maintained. Returning crop residue to the soil or regularly adding other organic material helps to maintain tilth, improves fertility, helps to prevent surface crusting, and increases the rate of water infiltration.

Pasture management may be difficult because of the flooding. Proper stocking rates, pasture rotation, and deferment of grazing during wet periods and following periods of flooding help to keep the pasture and the soils in good condition.

These soils are moderately suited to trees. Seedling mortality is a limitation because of the flooding. If protected from flooding, seedlings can survive and grow well. Competing vegetation can be controlled by careful site preparation or by spraying and cutting. Woodlots that are used for grazing are subject to compaction. Grazing also inhibits tree regeneration and causes root damage, which leads to heartrot and other diseases.

The land capability classification is IIIw.

5030—Pits, quarries. This map unit consists of pits from which limestone has been quarried, primarily for use in road construction and as agricultural lime. The pits are commonly 40 or more feet deep and are surrounded by piles of spoil 15 or more feet high. They range from a few acres to 40 acres in size and are irregularly shaped. Some contain water a few to many feet deep and have steep sides.

The spoil surrounding the pits varies in texture but generally is loamy and contains varying amounts of limestone fragments. It is derived from glacial till, eolian material, or a mixture of the two. In some areas it has been leveled and smoothed, but in others it is very uneven. In the leveled areas, grasses or trees grow

reasonably well. The content of organic matter in most of these areas is low. The spoil generally ranges from medium acid to mildly alkaline. It may be strongly acid, however, in the areas where it is derived from glacial till.

The quarries are well suited to wildlife habitat. Those containing water could support fish. Because of the steepness of the sides and the variable depth of the water, they could be dangerous as sites for recreation and wildlife habitat. Onsite investigation is needed to determine the hazard.

No land capability classification is assigned.

5040—Orthents, loamy. These nearly level to strongly sloping soils are in borrow areas, borrow pits, soil-filled areas, and other disturbed areas. A few areas are in landfills that are at least partly covered with local soil material. In some places the original soil has been removed to a depth of 3 to 10 feet, and in other places 2 to 5 feet of soil has been redistributed, commonly in an uneven pattern. The soils are moderately well drained or somewhat poorly drained, depending on the kind of material from which they were derived and the extent to which a borrow area is restored. Areas typically range from 3 to 40 acres in size.

The texture of these soils is loam, clay loam, silt loam, or sandy loam. The soil material typically is derived from loess, glacial till, or a mixture of the two. Permeability varies, depending on the texture and density of the soil material. Available water capacity is high or moderate. Runoff is slow to rapid. The content of organic matter is very low unless the topsoil has been redistributed throughout the area. Preparing a good seedbed may be difficult. Reaction typically is slightly acid or medium acid, but in some areas it is mildly alkaline.

These soils are better suited to grasses and legumes for hay and pasture than to cultivated crops. They are suited to cultivated crops only in some areas where the topsoil has been redistributed. Corn and soybeans are grown in a few of these areas. A system of conservation tillage that turns over as little soil as possible and leaves crop residue on the surface reduces the susceptibility to erosion and helps to stabilize the soils. Returning crop residue to the soil or regularly adding other organic material improves fertility and tilth.

No land capability classification is assigned.

Prime Farmland

Prime farmland is one of several kinds of important farmland defined by the U.S. Department of Agriculture. It is of major importance in meeting the Nation's short- and long-range needs for food and fiber. Because the supply of high quality farmland is limited, the U.S. Department of Agriculture recognizes that responsible levels of government, as well as individuals, should encourage and facilitate the wise use of our Nation's prime farmland.

Prime farmland, as defined by the U.S. Department of Agriculture, is the land that is best suited to food, feed, forage, fiber, and oilseed crops. It may be cultivated land, pasture, woodland, or other land, but it is not urban and built-up land or water areas. It either is used for food or fiber crops or is available for those crops. The soil qualities, growing season, and moisture supply are those needed for a well managed soil to produce a sustained high yield of crops in an economic manner. Prime farmland produces the highest yields with minimal inputs of energy and economic resources, and farming it results in the least damage to the environment.

Prime farmland has an adequate and dependable supply of moisture from precipitation or irrigation. The temperature and growing season are favorable. The level of acidity or alkalinity is acceptable. Prime farmland has few or no rocks and is permeable to water and air. It is not excessively erodible or saturated with water for long periods and is not frequently flooded during the growing season. The slope ranges mainly from 0 to 6 percent. More detailed information about the criteria for prime farmland is available at the local office of the Soil Conservation Service.

About 204,605 acres in the survey area, or nearly 57 percent of the total acreage, meets the soil requirements for prime farmland. Scattered areas of this land are throughout the county. The crops grown on this land, mainly corn and soybeans, account for an estimated two-thirds of the county's total agricultural income each year.

A recent trend in land use in some parts of the county has been the loss of some prime farmland to industrial and urban uses. The loss of prime farmland to other uses puts pressure on marginal lands, which generally are more erodible, droughty, and less productive and cannot be easily cultivated.

The map units in the survey area that are considered prime farmland are listed in table 5. This list does not constitute a recommendation for a particular land use. The extent of each listed map unit is shown in table 4. The location is shown on the detailed soil maps at the back of this publication. The soil qualities that affect use and management are described under the heading "Detailed Soil Map Units."

Soils that have limitations, such as a seasonal high water table, frequent flooding during the growing season, or inadequate rainfall, qualify for prime farmland only in areas where these limitations have been overcome by such measures as drainage, flood control, or irrigation. The need for these measures is indicated after the map unit name in table 5. Onsite evaluation is needed to determine whether or not these limitations have been overcome by corrective measures.

Use and Management of the Soils

This soil survey is an inventory and evaluation of the soils in the survey area. It can be used to adjust land uses to the limitations and potentials of natural resources and the environment. Also, it can help avoid soil-related failures in land uses.

In preparing a soil survey, soil scientists, conservationists, engineers, and others collect extensive field data about the nature and behavior characteristics of the soils. They collect data on erosion, droughtiness, flooding, and other factors that affect various soil uses and management. Field experience and collected data on soil properties and performance are used as a basis in predicting soil behavior.

Information in this section can be used to plan the use and management of soils for crops and pasture; as woodland; as sites for buildings, sanitary facilities, highways and other transportation systems, and parks and other recreation facilities; and for wildlife habitat. It can be used to identify the potentials and limitations of each soil for specific land uses and to help prevent construction failures caused by unfavorable soil properties.

Planners and others using soil survey information can evaluate the effect of specific land uses on productivity and on the environment in all or part of the survey area. The survey can help planners to maintain or create a land use pattern in harmony with the natural soil.

Contractors can use this survey to locate sources of sand and gravel, roadfill, and topsoil. They can use it to identify areas where bedrock, wetness, or very firm soil layers can cause difficulty in excavation.

Health officials, highway officials, engineers, and others may also find this survey useful. The survey can help them plan the safe disposal of wastes and locate sites for pavements, sidewalks, campgrounds, playgrounds, lawns, and trees and shrubs.

Crops and Pasture

General management needed for crops and pasture is suggested in this section. The crops or pasture plants best suited to the soils, including some not commonly grown in the survey area, are identified; the system of land capability classification used by the Soil Conservation Service is explained; and the estimated yields of the main crops and hay and pasture plants are listed for each soil.

Planners of management systems for individual fields or farms should consider the detailed information given in the description of each soil under "Detailed Soil Map Units." Specific information can be obtained from the local office of the Soil Conservation Service or the Cooperative Extension Service.

In 1981, about 257,280 acres in Washington County was used as cropland. Of this total, about 152,000 acres was planted to corn and 69,700 acres to soybeans. These two crops were grown on about 86 percent of the harvested cropland. The rest of the cropland was used principally for hay, oats, sorghum, and wheat.

The major concerns in managing the cropland and pasture in the county are described in the following paragraphs. These concerns are erosion, drainage, fertility, and tilth.

Water erosion is the main management concern on about 75 percent of the cropland and pasture in the county. If the slope is more than 2 percent, erosion is a hazard. Many of the areas that have a slope of less than 2 percent are subject to wind erosion unless they are protected.

Loss of the surface layer through erosion is damaging for many reasons. Erosion reduces the productivity of Billett, Chelsea, Dickinson, Lamont, Perks, and other soils that tend to be droughty. Productivity is reduced as the surface layer is lost and part of the subsoil is incorporated into the plow layer. The runoff rate tends to increase as the severity of erosion increases.

If the soil is eroded, more fuel generally is needed during seedbed preparation. Preparing a good seedbed and tillage are difficult on severely eroded soils because the original friable surface soil has been eroded away. For example, the exposed silty clay loam subsoil of the severely eroded Clinton soils is hard and cloddy after it has been worked when wet. Erosion adversely affects the physical condition of the soil, increases the likelihood of surface crusting, and inhibits seedling emergence.

Control of erosion helps to maintain the productivity of soils. It also minimizes the pollution of streams by sediment and thus improves water quality for municipal use, for recreation, and for fish and other wildlife.

Measures that control erosion generally provide a protective surface cover, reduce the runoff rate, and increase the rate of infiltration. A cropping system that keeps plants and plant residue on the surface for extended periods can hold soil losses to an amount that

will not reduce the productive capacity of the soils. On farms that have livestock, where part of the acreage is pasture or hayland, including grasses and legumes in the cropping sequence helps to control erosion in the more sloping areas and provides nitrogen and improves tilth for subsequent crops.

Many of the upland soils in the county are on short, steep, and irregular slopes. Contour tillage or terraces are impractical on some of these slopes. On these soils a cropping system that provides a substantial vegetative cover and conservation tillage are needed to control erosion.

The major conservation tillage systems include no-till, strip-till, ridge-till, and mulch-till. They are effective only if the amount of crop residue left on the surface after planting is enough to control erosion.

In areas where no-till, strip-till, and ridge-till systems are applied, the seedbed is prepared and the seeds planted in one operation. No-till, or slot tillage, is a system in which the surface is disturbed only in the immediate area of the planted seed row. A protective cover of crop residue is left on at least 90 percent of the surface (fig. 9). Strip-till is a system in which tillage is limited to a strip not wider than one-third of the row width. A protective cover of crop residue is left on two-thirds of the surface. Ridge-till is a system in which the seeds are planted on ridges that generally are 4 to 6 inches higher than the area between the rows. About one-third of the surface is tilled at planting time with sweeps or row cleaners. This system is effective on poorly drained soils, such as Taintor.

Mulch-till is a system in which the entire surface is loosened with tillage tools, such as chisels, field cultivators, and disks. Part of the crop residue is incorporated into the soil. Seedbed preparation and planting are accomplished in one operation or in separate operations.

A cover of pasture plants is effective in controlling erosion (fig. 10). The hazard of erosion is severe if the vegetative cover is destroyed when the more sloping pasture or hayland is renovated. If cultivated crops are grown prior to seeding for pasture, soil losses can be reduced by conservation tillage, contour farming, and grassed waterways. Interseeding grasses and legumes into the existing sod eliminates the need for destroying the plant cover during seedbed preparation.

Terraces and diversions reduce the length of slopes and thus help to control runoff and erosion. Terraces are

Figure 9.—No-till corn on Mahaska silty clay loam, 0 to 2 percent slopes, in the foreground and on Nira silty clay loam, 2 to 5 percent slopes, in the background.

Figure 10.—A pastured area of Clarinda silty clay loam, 9 to 14 percent slopes, moderately eroded.

most effective on well drained, gently sloping or moderately sloping soils that have smooth slopes. The gently and moderately sloping Clinton, Ladoga, and Otley soils typically are very well suited to terracing. Soils that have a subsoil of glacial till, such as Gara and Shelby soils, can be terraced, but care should be taken to ensure that the glacial till is not exposed. The topsoil should be stockpiled to cover areas of the less fertile glacial till subsoil.

Some soils are less well suited to terraces and diversions because of irregular slopes or a dense, clayey subsoil. Examples are Adair, Armstrong, Ashgrove, Clarinda, Galland, Keswick, Mystic, and Rinda soils. Terracing is also impractical on Nordness soils, which are shallow over limestone bedrock. Other soils that are generally unsuited to terracing are Billett, Chelsea, Lamont, and Sparta soils, which are coarse textured, droughty, and low in fertility. On these soils a cropping system that provides a substantial plant cover and a system of conservation tillage that leaves crop residue on the surface are needed to conserve moisture and prevent excessive water erosion. They also help to control wind erosion, which is a common hazard on these soils.

Contour farming and contour stripcropping help to control erosion on many soils in the county. They are most effective in areas where slopes are smooth and uniform, including most areas of Clinton, Ladoga, and Otley soils.

Fall plowing is not an acceptable practice on the very fragile soils in the county. Using a moldboard plow leaves very little crop residue on the surface and thus increases the susceptibility to erosion during periods of snowmelt and spring runoff.

Information about the design of erosion-control practices for each kind of soil is contained in the Technical Guide, which is available in local offices of the Soil Conservation Service.

Soil drainage is a major problem on about 30 percent of the soils in the county. Examples are the poorly drained Clarinda, Givin, Kalona, Rubio, Sperry, and Taintor soils in the uplands and the poorly drained Ackmore, Bremer, Colo, Tuskeego, and Zook soils in drainageways and on stream terraces and bottom land. All of these soils are more productive if subsurface tile is installed. Some areas of Bremer, Rubio, Tuskeego, and

Zook soils require a combination of subsurface tile and surface drains.

The design of both surface and subsurface drainage systems varies with the kind of soil and with the availability of drainage outlets. Tile drains should be spaced more closely in the moderately slowly permeable soils than in the more rapidly permeable soils. The wetness of the slowly permeable or very slowly permeable Adair, Armstrong, Ashgrove, Clarinda, Keswick, and Rinda soils can be reduced if interceptor tile is installed in the more rapidly permeable soils upslope.

Soil fertility is affected by reaction and the supply of available potassium and phosphorus. Most of the upland soils in the county have an acid subsoil. Applications of ground limestone are generally needed to raise the pH level sufficiently for alfalfa and other crops to grow well. Some of the severely eroded soils that formed in glacial till are calcareous in the surface soil and subsoil. Examples are the severely eroded Gara, Lindley, and Shelby soils.

The supply of available potassium typically is low or very low in the subsoil of Clinton, Ladoga, Otley, and most other upland soils. The supply of available phosphorus is higher in the subsoil of timbered soils, such as Clinton soils, than in the subsoil of prairie soils, such as Otley soils. On all soils additions of lime and fertilizer should be based on results of soil tests, on the needs of the crops, and on the expected level of yields. The Cooperative Extension Service can help in determining the kinds and amounts of lime and fertilizer needed.

Soil tilth has important effects on the germination of seeds and the infiltration of water into the soil. Soils with good tilth generally are higher in content of organic matter than other soils, are porous, have granular structure, and have a moderate content of clay in the surface layer. Most of the cultivated soils in the county have a surface layer of silt loam or silty clay loam. In some soils, such as Clinton soils, the content of organic matter is low and the structure of the surface layer is weak. The surface of these soils crusts during periods of intense rainfall. When dry, the crust is hard and thus reduces the rate of water infiltration and increases the runoff rate. Regular additions of crop residue, manure, and other organic material improve soil structure and help to prevent excessive crusting.

Field crops that are suited to the soils and climate of the county include many crops that are not commonly grown. Corn and soybeans are the most common crops. Oats is the most common close growing crop. Grain sorghum, sunflowers, potatoes, sugar beets, sweet corn, popcorn, pumpkins, sugar cane, canning peas, canning beans, and navy beans can be grown if economic conditions are favorable. Rye, barley, buckwheat, wheat, and flax also can be grown. Grass seed could be produced from bromegrass, redtop, bluegrass, switchgrass, big bluestem, and indiangrass.

Pasture and hay crops that are suited to the soils and climate of the county include several legumes, cool-season grasses, and warm-season grasses. Most of the soils used for permanent pasture are seeded to bluegrass or bromegrass. Other cool-season grasses that are well adapted to the county include orchardgrass, tall fescue, timothy, and reed canarygrass.

Alfalfa and red clover are the most common legumes grown for hay. They are also grown in mixtures with orchardgrass, bromegrass, or timothy for hay and pasture. Birdsfoot trefoil is grown in mixtures with bluegrass, orchardgrass, bromegrass, or tall fescue for pasture. Other legumes that can be grown in pastured areas are crownvetch, ladino, and alsike clover.

Forage production can be increased by planting warm-season grasses, including switchgrass, big bluestem, and indiangrass. These grasses grow well during the warm summer months, but they require special management when they are becoming established and when they are grazed.

Good management is needed in all pastured areas. It is especially important in steeply sloping areas where measures that prevent surface compaction and gully erosion are needed. On established stands this management includes applications of fertilizer, weed and brush control, rotation or deferred grazing where a full-season grazing system is used, proper stocking rates, and adequate livestock watering facilities.

Specialty crops are grown commercially in the county only to a limited extent. Apples are the only specialty crop grown, although most of the well drained soils are suitable for orchards and nursery plants. Soils in low landscape positions where frost is frequent and air drainage is poor generally are poorly suited to early vegetables, small fruits, and orchards. The latest information about growing specialty crops can be obtained from the local office of the Cooperative Extension Service or the Soil Conservation Service.

Yields Per Acre

The average yields per acre that can be expected of the principal crops under a high level of management are shown in table 6. In any given year, yields may be higher or lower than those indicated in the table because of variations in rainfall and other climatic factors. The land capability classification of each map unit also is shown in the table.

The yields are based mainly on the experience and records of farmers, conservationists, and extension agents. Available yield data from nearby counties and results of field trials and demonstrations are also considered.

The management needed to obtain the indicated yields of the various crops depends on the kind of soil

and the crop. Management can include drainage, erosion control, and protection from flooding; the proper planting and seeding rates; suitable high-yielding crop varieties; appropriate and timely tillage; control of weeds, plant diseases, and harmful insects; favorable soil reaction and optimum levels of nitrogen, phosphorus, potassium, and trace elements for each crop; effective use of crop residue, barnyard manure, and green manure crops; and harvesting that ensures the smallest possible loss.

The estimated yields reflect the productive capacity of each soil for each of the principal crops. Yields are likely to increase as new production technology is developed. The productivity of a given soil compared with that of other soils, however, is not likely to change.

Crops other than those shown in table 6 are grown in the survey area, but estimated yields are not listed because the acreage of such crops is small. The local office of the Soil Conservation Service or of the Cooperative Extension Service can provide information about the management and productivity of the soils for those crops.

Land Capability Classification

Land capability classification shows, in a general way, the suitability of soils for most kinds of field crops. Crops that require special management are excluded. The soils are grouped according to their limitations for field crops, the risk of damage if they are used for crops, and the way they respond to management. The criteria used in grouping the soils do not include major and generally expensive landforming that would change slope, depth, or other characteristics of the soils, nor do they include possible but unlikely major reclamation projects. Capability classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for woodland and for engineering purposes.

In the capability system, soils are generally grouped at three levels: capability class, subclass, and unit. Only class and subclass are used in this survey.

Capability classes, the broadest groups, are designated by Roman numerals I through VIII. The numerals indicate progressively greater limitations and narrower choices for practical use. The classes are defined as follows:

Class I soils have few limitations that restrict their use.

Class II soils have moderate limitations that reduce the choice of plants or that require moderate conservation practices.

Class III soils have severe limitations that reduce the choice of plants or that require special conservation practices, or both.

Class IV soils have very severe limitations that reduce the choice of plants or that require very careful management, or both.

Class V soils are not likely to erode but have other limitations, impractical to remove, that limit their use.

Class VI soils have severe limitations that make them generally unsuitable for cultivation.

Class VII soils have very severe limitations that make them unsuitable for cultivation.

Class VIII soils and miscellaneous areas have limitations that nearly preclude their use for commercial crop production.

Capability subclasses are soil groups within one class. They are designated by adding a small letter, *e, w, s,* or *c,* to the class numeral, for example, IIe. The letter *e* shows that the main limitation is risk of erosion unless close-growing plant cover is maintained; *w* shows that water in or on the soil interferes with plant growth or cultivation (in some soils the wetness can be partly corrected by artificial drainage); *s* shows that the soil is limited mainly because it is shallow, droughty, or stony; and *c*, used in only some parts of the United States, shows that the chief limitation is climate that is very cold or very dry.

In class I there are no subclasses because the soils of this class have few limitations. Class V contains only the subclasses indicated by *w, s,* or *c* because the soils in class V are subject to little or no erosion. They have other limitations that restrict their use to pasture, woodland, wildlife habitat, or recreation.

The capability classification of each map unit is given in the section "Detailed Soil Map Units" and in the yields table.

Woodland Management and Productivity

Bruce Plum, forester, Iowa Conservation Commission, helped prepare this section.

Forests once covered about 90,000 acres in Washington County, or 25 percent of the total acreage. The woodland was dominantly in the northern and southwestern parts of the county. It was on ridgetops, side slopes, and bottom land. The soils on the ridgetops are mainly the gently sloping and moderately sloping Ladoga, Hedrick, and Clinton soils. Clinton soils are on most of the ridgetops that remain wooded.

The native tree species were northern red oak, American elm, black walnut, shagbark hickory, bitternut hickory, American basswood, green ash, and white ash. The early settlers used the timber for lumber and fuel. Eventually, the woodland was cleared and was used for agricultural purposes until the soils were depleted by erosion. Selective native species in the areas that were not converted to agricultural land were excessively harvested and were replaced by lesser oaks and elms because of the poor seed quality of poorly formed and inferior trees.

Woodland currently makes up about 20,000 acres in the county, or 5 percent of the total acreage. Most of this woodland is on strongly sloping to very steep side slopes in areas of the Clinton-Lindley soil association, which is described under the heading "General Soil Map

Units." These areas are adjacent to the English, Iowa, and Skunk Rivers and their major tributaries and along Crooked Creek. The slopes bordering these watercourses are too steep for cultivation and are poorly suited to pasture.

Pasturing or overgrazing of woodland is detrimental to both the trees and the soil. Overgrazing causes compaction, which reduces the growth rates and vigor of trees and other vegetation. Trees that are under stress because of compaction are more susceptible to insects and disease. Livestock hooves can remove bark from the base of the trees, leaving open wounds and thus increasing the susceptibility to insects and disease. Debarking is so severe in some areas that the trees are girdled. Rills form along livestock trails in steep wooded areas. Gullying generally occurs unless the formation of rills is controlled. The forest vegetation in these areas is very important because it helps to control erosion.

The woodland can be productive if it is protected from livestock, fire, insects, and diseases and if proper management is applied. This management includes proper harvesting methods and measures that improve the timber stands. Seed tree, shelterwood, selective, and clearcutting methods are used for harvesting. The measures that improve timber stands include removal of undesired and poorly formed species, regeneration of the desired species, and thinning at the proper age intervals. Selection of species that are suited to the soil also is important.

The amount of moisture in the soil, aspect, the susceptibility to erosion, reaction, and fertility affect the productivity of woodland. The amount of moisture is affected by soil depth, slope, texture, permeability, and internal drainage. Aspect is the direction that the slope faces. North- and east-facing slopes tend to be cooler and more moist than south- and west-facing slopes. Therefore, they are usually more productive. Because they tend to be acid, eroded soils generally are better sites for some coniferous species than for hardwoods. Hardwoods grow better on neutral or slightly calcareous soils and on the more fertile soils than on other soils.

Table 7 can be used by woodland owners or forest managers in planning the use of soils for wood crops. Only those soils suitable for wood crops are listed. The table lists the ordination symbol for each suitable soil. Soils assigned the same ordination symbol require the same general management and have about the same potential productivity.

The first part of the *ordination symbol*, a number, indicates the potential productivity of the soils for important trees. It is based on the site index of the species listed first in the *common trees* column. The number 1 indicates very high productivity; 2, high; 3, moderately high; 4, moderate; and 5, low. The second part of the symbol, a letter, indicates the major kind of soil limitation. The letter *r* indicates steep slopes; *x*, stoniness or rockiness; *w*, excessive water in or on the soil; *t*, toxic substances in the soil; *d*, restricted rooting depth; *c*, clay in the upper part of the soil; *s*, sandy texture; and *f*, high content of coarse fragments in the soil profile. The letter *a* indicates that limitations or restrictions are insignificant. If a soil has more than one limitation, the priority is as follows: r, x, w, t, d, c, s, and f.

In table 7, *slight, moderate,* and *severe* indicate the degree of the major soil limitations to be considered in management.

Ratings of the *erosion hazard* indicate the risk of loss of soil in well managed woodland. The risk is *slight* if the expected soil loss is small, *moderate* if measures are needed to control erosion during logging and road construction, and *severe* if intensive management or special equipment and methods are needed to prevent excessive loss of soil.

Ratings of *equipment limitation* reflect the characteristics and conditions of the soil that restrict use of the equipment generally needed in woodland management or harvesting. A rating of *slight* indicates that use of equipment is not limited to a particular kind of equipment or time of year; *moderate* indicates a short seasonal limitation or a need for some modification in management or in equipment; and *severe* indicates a seasonal limitation, a need for special equipment or management, or a hazard in the use of equipment.

Seedling mortality ratings indicate the degree to which the soil affects the mortality of tree seedlings. Plant competition is not considered in the ratings. The ratings apply to seedlings from good stock that are properly planted during a period of sufficient rainfall. A rating of *slight* indicates that the expected mortality is less than 25 percent; *moderate*, 25 to 50 percent; and *severe*, more than 50 percent.

Ratings of *windthrow hazard* are based on soil characteristics that affect the development of tree roots and the ability of the soil to hold trees firmly. A rating of *slight* indicates that few trees may be blown down by strong winds; *moderate*, that some trees will be blown down during periods of excessive soil wetness and strong winds; and *severe*, that many trees are blown down during periods of excessive soil wetness and moderate or strong winds.

The *potential productivity* of merchantable or *common trees* on a soil is expressed as a *site index*. This index is the average height, in feet, that dominant and codominant trees of a given species attain in a specified number of years. The site index applies to fully stocked, even-aged, unmanaged stands. Commonly grown trees are those that woodland managers generally favor in intermediate or improvement cuttings. They are selected on the basis of growth rate, quality, value, and marketability.

Trees to plant are those that are suited to the soils and to commercial wood production.

Windbreaks and Environmental Plantings

Windbreaks protect livestock, buildings, and yards from wind and snow. They also protect fruit trees and gardens, and they furnish habitat for wildlife. Several rows of low- and high-growing broadleaf and coniferous trees and shrubs provide the most protection.

Field windbreaks are narrow plantings made at right angles to the prevailing wind and at specific intervals across the field. The interval depends on the erodibility of the soil. Field windbreaks protect cropland and crops from wind, help to keep snow on the fields, reduce energy requirements, and provide food and cover for wildlife.

Environmental plantings help to beautify and screen houses and other buildings and to abate noise. The plants, mostly evergreen shrubs and trees, are closely spaced. To ensure plant survival, a healthy planting stock of suitable species should be planted properly on a well prepared site and maintained in good condition.

Table 8 shows the height that locally grown trees and shrubs are expected to reach in 20 years on various soils. The estimates in table 8 are based on measurements and observation of established plantings that have been given adequate care. They can be used as a guide in planning windbreaks and screens. Additional information on planning windbreaks and screens and planting and caring for trees and shrubs can be obtained from local offices of the Soil Conservation Service or the Cooperative Extension Service or from a commercial nursery.

Recreation

The soils of the survey area are rated in table 9 according to limitations that affect their suitability for recreation. The ratings are based on restrictive soil features, such as wetness, slope, and texture of the surface layer. Susceptibility to flooding is considered. Not considered in the ratings, but important in evaluating a site, are the location and accessibility of the area, the size and shape of the area and its scenic quality, vegetation, access to water, potential water impoundment sites, and access to public sewerlines. The capacity of the soil to absorb septic tank effluent and the ability of the soil to support vegetation are also important. Soils subject to flooding are limited for recreation use by the duration and intensity of flooding and the season when flooding occurs. In planning recreation facilities, onsite assessment of the height, duration, intensity, and frequency of flooding is essential.

In table 9, the degree of soil limitation is expressed as slight, moderate, or severe. *Slight* means that soil properties are generally favorable and that limitations are minor and easily overcome. *Moderate* means that limitations can be overcome or alleviated by planning, design, or special maintenance. *Severe* means that soil properties are unfavorable and that limitations can be offset only by costly soil reclamation, special design, intensive maintenance, limited use, or by a combination of these measures.

The information in table 9 can be supplemented by other information in this survey, for example, interpretations for septic tank absorption fields in table 12 and interpretations for dwellings without basements and for local roads and streets in table 11.

Camp areas require site preparation, such as shaping and leveling the tent and parking areas, stabilizing roads and intensively used areas, and installing sanitary facilities and utility lines. Camp areas are subject to heavy foot traffic and some vehicular traffic. The best soils have mild slopes and are not wet or subject to flooding during the period of use. The surface has few or no stones or boulders, absorbs rainfall readily but remains firm, and is not dusty when dry. Strong slopes and stones or boulders can greatly increase the cost of constructing campsites.

Picnic areas are subject to heavy foot traffic. Most vehicular traffic is confined to access roads and parking areas. The best soils for picnic areas are firm when wet, are not dusty when dry, are not subject to flooding during the period of use, and do not have slopes or stones or boulders that increase the cost of shaping sites or of building access roads and parking areas.

Playgrounds require soils that can withstand intensive foot traffic. The best soils are almost level and are not wet or subject to flooding during the season of use. The surface is free of stones and boulders, is firm after rains, and is not dusty when dry. If grading is needed, the depth of the soil over bedrock should be considered.

Paths and trails for hiking and horseback riding should require little or no cutting and filling. The best soils are not wet, are firm after rains, are not dusty when dry, and are not subject to flooding more than once a year during the period of use. They have moderate slopes and few or no stones or boulders on the surface.

Golf fairways are subject to heavy foot traffic and some light vehicular traffic. Cutting or filling may be required. The best soils for use as golf fairways are firm when wet, are not dusty when dry, and are not subject to prolonged flooding during the period of use. They have moderate slopes and no stones or boulders on the surface. The suitability of the soil for tees or greens is not considered in rating the soils.

Wildlife Habitat

Washington County has a varied population of wildlife. Ring-necked pheasant, turkey, quail, white-tailed deer, gray and fox squirrels, cottontail rabbit, and raccoon are the major upland game species. Except for the ring-necked pheasant, they mainly inhabit the steep wooded areas along the major watercourses. The ring-necked pheasant inhabits open areas where fence rows provide shelter.

The English, Iowa, and Skunk Rivers and Lake Darling provide most of the opportunities for fishing in the county. They are inhabited by various fish species, including catfish, crappie, northern pike, walleye, and rough fish.

The population of waterfowl has been greatly reduced because of the loss of wetland habitat. Migrating waterfowl frequent the farm ponds and the backwater areas along the rivers.

Soils affect the kind and amount of vegetation that is available to wildlife as food and cover. They also affect the construction of water impoundments. The kind and abundance of wildlife depend largely on the amount and distribution of food, cover, and water. Wildlife habitat can be created or improved by planting appropriate vegetation, by maintaining the existing plant cover, or by promoting the natural establishment of desirable plants.

In table 10, the soils in the survey area are rated according to their potential for providing habitat for various kinds of wildlife. This information can be used in planning parks, wildlife refuges, nature study areas, and other developments for wildlife; in selecting soils that are suitable for establishing, improving, or maintaining specific elements of wildlife habitat; and in determining the intensity of management needed for each element of the habitat.

The potential of the soil is rated good, fair, poor, or very poor. A rating of *good* indicates that the element or kind of habitat is easily established, improved, or maintained. Few or no limitations affect management, and satisfactory results can be expected. A rating of *fair* indicates that the element or kind of habitat can be established, improved, or maintained in most places. Moderately intensive management is required for satisfactory results. A rating of *poor* indicates that limitations are severe for the designated element or kind of habitat. Habitat can be created, improved, or maintained in most places, but management is difficult and must be intensive. A rating of *very poor* indicates that restrictions for the element or kind of habitat are very severe and that unsatisfactory results can be expected. Creating, improving, or maintaining habitat is impractical or impossible.

The elements of wildlife habitat are described in the following paragraphs.

Grain and seed crops are domestic grains and seed-producing herbaceous plants. Soil properties and features that affect the growth of grain and seed crops are depth of the root zone, texture of the surface layer, available water capacity, wetness, slope, surface stoniness, and flood hazard. Soil temperature and soil moisture are also considerations. Examples of grain and seed crops are corn, wheat, oats, and barley.

Grasses and legumes are domestic perennial grasses and herbaceous legumes. Soil properties and features that affect the growth of grasses and legumes are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, flood hazard, and slope. Soil temperature and soil moisture are also considerations. Examples of grasses and legumes are fescue, orchardgrass, bromegrass, clover, and alfalfa.

Wild herbaceous plants are native or naturally established grasses and forbs, including weeds. Soil properties and features that affect the growth of these plants are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, and flood hazard. Soil temperature and soil moisture are also considerations. Examples of wild herbaceous plants are bluestem, goldenrod, beggarweed, wheatgrass, and grama.

Hardwood trees and woody understory produce nuts or other fruit, buds, catkins, twigs, bark, and foliage. Soil properties and features that affect the growth of hardwood trees and shrubs are depth of the root zone, available water capacity, and wetness. Examples of these plants are oak, poplar, cherry, sweetgum, apple, hawthorn, dogwood, hickory, blackberry, and elderberry. Examples of fruit-producing shrubs that are suitable for planting on soils rated *good* are Russian-olive, autumn-olive, and crabapple.

Coniferous plants furnish browse and seeds. Soil properties and features that affect the growth of coniferous trees, shrubs, and ground cover are depth of the root zone, available water capacity, and wetness. Examples of coniferous plants are pine, spruce, fir, cedar, and juniper.

Wetland plants are annual and perennial wild herbaceous plants that grow on moist or wet sites. Submerged or floating aquatic plants are excluded. Soil properties and features affecting wetland plants are texture of the surface layer, wetness, reaction, salinity, slope, and surface stoniness. Examples of wetland plants are smartweed, wild millet, wildrice, cordgrass, rushes, sedges, and reeds.

Shallow water areas have an average depth of less than 5 feet. Some are naturally wet areas. Others are created by dams, levees, or other water-control structures. Soil properties and features affecting shallow water areas are depth to bedrock, wetness, surface stoniness, slope, and permeability. Examples of shallow water areas are marshes, waterfowl feeding areas, and ponds.

The habitat for various kinds of wildlife is described in the following paragraphs.

Habitat for openland wildlife consists of cropland, pasture, meadows, and areas that are overgrown with grasses, herbs, shrubs, and vines. These areas produce grain and seed crops, grasses and legumes, and wild herbaceous plants. The wildlife attracted to these areas include bobwhite quail, pheasant, meadowlark, field sparrow, cottontail, and red fox.

Habitat for woodland wildlife consists of areas of deciduous plants or coniferous plants or both and associated grasses, legumes, and wild herbaceous

plants. Wildlife attracted to these areas include wild turkey, ruffed grouse, woodcock, thrushes, woodpeckers, squirrels, gray fox, raccoon, and deer.

Habitat for wetland wildlife consists of open, marshy or swampy shallow water areas. Some of the wildlife attracted to such areas are ducks, geese, herons, shore birds, muskrat, mink, and beaver.

Engineering

This section provides information for planning land uses related to urban development and to water management. Soils are rated for various uses, and the most limiting features are identified. The ratings are given in the following tables: Building site development, Sanitary facilities, Construction materials, and Water management. The ratings are based on observed performance of the soils and on the estimated data and test data in the "Soil Properties" section.

Information in this section is intended for land use planning, for evaluating land use alternatives, and for planning site investigations prior to design and construction. The information, however, has limitations. For example, estimates and other data generally apply only to that part of the soil within a depth of 5 or 6 feet. Because of the map scale, small areas of different soils may be included within the mapped areas of a specific soil.

The information is not site specific and does not eliminate the need for onsite investigation of the soils or for testing and analysis by personnel experienced in the design and construction of engineering works.

Government ordinances and regulations that restrict certain land uses or impose specific design criteria were not considered in preparing the information in this section. Local ordinances and regulations need to be considered in planning, in site selection, and in design.

Soil properties, site features, and observed performance were considered in determining the ratings in this section. During the fieldwork for this soil survey, determinations were made about grain-size distribution, liquid limit, plasticity index, soil reaction, depth to bedrock, hardness of bedrock within 5 to 6 feet of the surface, soil wetness, depth to a seasonal high water table, slope, likelihood of flooding, natural soil structure aggregation, and soil density. Data were collected about kinds of clay minerals, mineralogy of the sand and silt fractions, and the kind of adsorbed cations. Estimates were made for erodibility, permeability, corrosivity, shrink-swell potential, available water capacity, and other behavioral characteristics affecting engineering uses.

This information can be used to (1) evaluate the potential of areas for residential, commercial, industrial, and recreation uses; (2) make preliminary estimates of construction conditions; (3) evaluate alternative routes for roads, streets, highways, pipelines, and underground cables; (4) evaluate alternative sites for sanitary landfills, septic tank absorption fields, and sewage lagoons; (5) plan detailed onsite investigations of soils and geology; (6) locate potential sources of gravel, sand, earthfill, and topsoil; (7) plan drainage systems, irrigation systems, ponds, terraces, and other structures for soil and water conservation; and (8) predict performance of proposed small structures and pavements by comparing the performance of existing similar structures on the same or similar soils.

The information in the tables, along with the soil maps, the soil descriptions, and other data provided in this survey can be used to make additional interpretations.

Some of the terms used in this soil survey have a special meaning in soil science and are defined in the Glossary.

Building Site Development

Table 11 shows the degree and kind of soil limitations that affect shallow excavations, dwellings with and without basements, small commercial buildings, local roads and streets, and lawns and landscaping. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required. Special feasibility studies may be required where the soil limitations are severe.

Shallow excavations are trenches or holes dug to a maximum depth of 5 or 6 feet for basements, graves, utility lines, open ditches, and other purposes. The ratings are based on soil properties, site features, and observed performance of the soils. The ease of digging, filling, and compacting is affected by the depth to bedrock or a very firm dense layer, stone content, soil texture, and slope. The time of the year that excavations can be made is affected by the depth to a seasonal high water table and the susceptibility of the soil to flooding. The resistance of the excavation walls or banks to sloughing or caving is affected by soil texture and the depth to the water table.

Dwellings and small commercial buildings are structures built on shallow foundations on undisturbed soil. The load limit is the same as that for single-family dwellings no higher than three stories. Ratings are made for small commercial buildings without basements, for dwellings with basements, and for dwellings without basements. The ratings are based on soil properties, site features, and observed performance of the soils. A high water table, flooding, shrink-swell potential, and organic layers can cause the movement of footings. A high water

table, depth to bedrock, large stones, slope, and flooding affect the ease of excavation and construction. Landscaping and grading that require cuts and fills of more than 5 to 6 feet are not considered.

Local roads and streets have an all-weather surface and carry automobile and light truck traffic all year. They have a subgrade of cut or fill soil material, a base of gravel, crushed rock, or stabilized soil material, and a flexible or rigid surface. Cuts and fills are generally limited to less than 6 feet. The ratings are based on soil properties, site features, and observed performance of the soils. Depth to bedrock, a high water table, flooding, large stones, and slope affect the ease of excavating and grading. Soil strength (as inferred from the engineering classification of the soil), shrink-swell potential, frost action potential, and depth to a high water table affect the traffic supporting capacity.

Lawns and landscaping require soils on which turf and ornamental trees and shrubs can be established and maintained. The ratings are based on soil properties, site features, and observed performance of the soils. Soil reaction, a high water table, depth to bedrock, the available water capacity in the upper 40 inches, and the content of calcium carbonate affect plant growth. Flooding, wetness, slope, stoniness, and the amount of sand, clay, or organic matter in the surface layer affect trafficability after vegetation is established.

Sanitary Facilities

Table 12 shows the degree and kind of soil limitations that affect septic tank absorption fields, sewage lagoons, and sanitary landfills. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required.

Table 12 also shows the suitability of the soils for use as daily cover for landfills. A rating of *good* indicates that soil properties and site features are favorable for the use and good performance and low maintenance can be expected; *fair* indicates that soil properties and site features are moderately favorable for the use and one or more soil properties or site features make the soil less desirable than the soils rated good; and *poor* indicates that one or more soil properties or site features are unfavorable for the use and overcoming the unfavorable properties requires special design, extra maintenance, or costly alteration.

Septic tank absorption fields are areas in which effluent from a septic tank is distributed into the soil through subsurface tiles or perforated pipe. Only that part of the soil between depths of 24 and 72 inches is evaluated. The ratings are based on soil properties, site features, and observed performance of the soils. Permeability, a high water table, depth to bedrock, and flooding affect absorption of the effluent. Large stones and bedrock interfere with installation.

Unsatisfactory performance of septic tank absorption fields, including excessively slow absorption of effluent, surfacing of effluent, and hillside seepage, can affect public health. Ground water can be polluted if highly permeable sand and gravel or fractured bedrock is less than 4 feet below the base of the absorption field, if slope is excessive, or if the water table is near the surface. There must be unsaturated soil material beneath the absorption field to filter the effluent effectively. Many local ordinances require that this material be of a certain thickness.

Sewage lagoons are shallow ponds constructed to hold sewage while aerobic bacteria decompose the solid and liquid wastes. Lagoons should have a nearly level floor surrounded by cut slopes or embankments of compacted soil. Lagoons generally are designed to hold the sewage within a depth of 2 to 5 feet. Nearly impervious soil material for the lagoon floor and sides is required to minimize seepage and contamination of ground water.

Table 12 gives ratings for the natural soil that makes up the lagoon floor. The surface layer and, generally, 1 or 2 feet of soil material below the surface layer are excavated to provide material for the embankments. The ratings are based on soil properties, site features, and observed performance of the soils. Considered in the ratings are slope, permeability, a high water table, depth to bedrock, flooding, large stones, and content of organic matter.

Excessive seepage due to rapid permeability of the soil or a water table that is high enough to raise the level of sewage in the lagoon causes a lagoon to function unsatisfactorily. Pollution results if seepage is excessive or if floodwater overtops the lagoon. A high content of organic matter is detrimental to proper functioning of the lagoon because it inhibits aerobic activity. Slope and bedrock can cause construction problems, and large stones can hinder compaction of the lagoon floor.

Sanitary landfills are areas where solid waste is disposed of by burying it in soil. There are two types of landfill—trench and area. In a trench landfill, the waste is placed in a trench. It is spread, compacted, and covered daily with a thin layer of soil excavated at the site. In an area landfill, the waste is placed in successive layers on the surface of the soil. The waste is spread, compacted, and covered daily with a thin layer of soil from a source away from the site.

Both types of landfill must be able to bear heavy vehicular traffic. Both types involve a risk of ground water pollution. Ease of excavation and revegetation needs to be considered.

The ratings in table 12 are based on soil properties, site features, and observed performance of the soils. Permeability, depth to bedrock, a high water table, slope, and flooding affect both types of landfill. Texture, stones and boulders, highly organic layers, and soil reaction affect trench type landfills. Unless otherwise stated, the ratings apply only to that part of the soil within a depth of about 6 feet. For deeper trenches, a limitation rated slight or moderate may not be valid. Onsite investigation is needed.

Daily cover for landfill is the soil material that is used to cover compacted solid waste in an area type sanitary landfill. The soil material is obtained offsite, transported to the landfill, and spread over the waste.

Soil texture, wetness, coarse fragments, and slope affect the ease of removing and spreading the material during wet and dry periods. Loamy or silty soils that are free of large stones or excess gravel are the best cover for a landfill. Clayey soils are sticky or cloddy and are difficult to spread; sandy soils are subject to wind erosion.

After soil material has been removed, the soil material remaining in the borrow area must be thick enough over bedrock or the water table to permit revegetation. The soil material used as final cover for a landfill should be suitable for plants. The surface layer generally has the best workability, more organic matter, and the best potential for plants. Material from the surface layer should be stockpiled for use as the final cover.

Construction Materials

Table 13 gives information about the soils as a source of roadfill, sand, gravel, and topsoil. The soils are rated *good, fair,* or *poor* as a source of roadfill and topsoil. They are rated as a *probable* or *improbable* source of sand and gravel. The ratings are based on soil properties and site features that affect the removal of the soil and its use as construction material. Normal compaction, minor processing, and other standard construction practices are assumed. Each soil is evaluated to a depth of 5 or 6 feet.

Roadfill is soil material that is excavated in one place and used in road embankments in another place. In this table, the soils are rated as a source of roadfill for low embankments, generally less than 6 feet high and less exacting in design than higher embankments.

The ratings are for the soil material below the surface layer to a depth of 5 or 6 feet. It is assumed that soil layers will be mixed during excavating and spreading. Many soils have layers of contrasting suitability within their profile. The table showing engineering index properties provides detailed information about each soil layer. This information can help determine the suitability of each layer for use as roadfill. The performance of soil after it is stabilized with lime or cement is not considered in the ratings.

The ratings are based on soil properties, site features, and observed performance of the soils. The thickness of suitable material is a major consideration. The ease of excavation is affected by large stones, a high water table, and slope. How well the soil performs in place after it has been compacted and drained is determined by its strength (as inferred from the engineering classification of the soil) and shrink-swell potential.

Soils rated *good* contain significant amounts of sand or gravel or both. They have at least 5 feet of suitable material, low shrink-swell potential, few cobbles and stones, and slopes of 15 percent or less. Depth to the water table is more than 3 feet. Soils rated *fair* are more than 35 percent silt- and clay-sized particles and have a plasticity index of less than 10. They have moderate shrink-swell potential, slopes of 15 to 25 percent, or many stones. Depth to the water table is 1 to 3 feet. Soils rated *poor* have a plasticity index of more than 10, a high shrink-swell potential, many stones, or slopes of more than 25 percent. They are wet, and the depth to the water table is less than 1 foot. They may have layers of suitable material, but the material is less than 3 feet thick.

Sand and gravel are natural aggregates suitable for commercial use with a minimum of processing. Sand and gravel are used in many kinds of construction. Specifications for each use vary widely. In table 13, only the probability of finding material in suitable quantity is evaluated. The suitability of the material for specific purposes is not evaluated, nor are factors that affect excavation of the material.

The properties used to evaluate the soil as a source of sand or gravel are gradation of grain sizes (as indicated by the engineering classification of the soil), the thickness of suitable material, and the content of rock fragments. Kinds of rock, acidity, and stratification are given in the soil series descriptions. Gradation of grain sizes is given in the table on engineering index properties.

A soil rated as a probable source has a layer of clean sand or gravel or a layer of sand or gravel that is up to 12 percent silty fines. This material must be at least 3 feet thick and less than 50 percent, by weight, large stones. All other soils are rated as an improbable source. Coarse fragments of soft bedrock, such as shale and siltstone, are not considered to be sand and gravel.

Topsoil is used to cover an area so that vegetation can be established and maintained. The upper 40 inches of a soil is evaluated for use as topsoil. Also evaluated is the reclamation potential of the borrow area.

Plant growth is affected by such properties as soil reaction, available water capacity, and fertility. The ease of excavating, loading, and spreading is affected by rock fragments, slope, a water table, soil texture, and thickness of suitable material. Reclamation of the borrow area is affected by slope, a water table, rock fragments, and bedrock.

Soils rated *good* have friable loamy material to a depth of at least 40 inches. They are free of stones and cobbles, have little or no gravel, and have slopes of less than 8 percent. They are naturally fertile or respond well to fertilizer and are not so wet that excavation is difficult.

Soils rated *fair* are sandy soils, loamy soils that have a relatively high content of clay, soils that have only 20 to 40 inches of suitable material, soils that have an appreciable amount of gravel and stones, or soils that have slopes of 8 to 15 percent. The soils are not so wet that excavation is difficult.

Soils rated *poor* are very sandy or clayey, have less than 20 inches of suitable material, have a large amount of gravel, stones, or soluble salts, have slopes of more than 15 percent, or have a seasonal water table at or near the surface.

The surface layer of most soils is generally preferred for topsoil because of its organic matter content. Organic matter greatly increases the absorption and retention of moisture and nutrients for plant growth.

Water Management

Table 14 gives information on the soil properties and site features that affect water management. The degree and kind of soil limitations are given for pond reservoir areas; embankments, dikes, and levees; and aquifer-fed excavated ponds. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and are easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increase in construction costs, and possibly increased maintenance are required.

This table also gives for each soil the restrictive features that affect drainage, terraces and diversions, and grassed waterways.

Pond reservoir areas hold water behind a dam or embankment. Soils best suited to this use have low seepage potential in the upper 60 inches. The seepage potential is determined by the permeability of the soil and the depth to fractured bedrock or other permeable material. Excessive slope can affect the storage capacity of the reservoir area.

Embankments, dikes, and levees are raised structures of soil material, generally less than 20 feet high, constructed to impound water or to protect land against overflow. In this table, the soils are rated as a source of material for embankment fill. The ratings apply to the soil material below the surface layer to a depth of about 5 feet. It is assumed that soil layers will be uniformly mixed and compacted during construction.

The ratings do not indicate the ability of the natural soil to support an embankment. Soil properties to a depth even greater than the height of the embankment can affect performance and safety of the embankment. Generally, deeper onsite investigation is needed to determine these properties.

Soil material in embankments must be resistant to seepage, piping, and erosion and have favorable compaction characteristics. Unfavorable features include less than 5 feet of suitable material and a high content of stones or boulders or of organic matter. A high water table affects the amount of usable material. It also affects trafficability.

Aquifer-fed excavated ponds are pits or dugouts that extend to a ground water aquifer or to a depth below a permanent water table. Excluded are ponds that are fed only by surface runoff and embankment ponds that impound water 3 feet or more above the original surface. Excavated ponds are affected by depth to a permanent water table, permeability of the aquifer, and quality of the water as inferred from the salinity of the soil. Depth to bedrock and the content of large stones affect the ease of excavation.

Drainage is the removal of excess surface and subsurface water from the soil. How easily and effectively the soil is drained depends on the depth to bedrock or to other layers that affect the rate of water movement; permeability; depth to a high water table or depth of standing water if the soil is subject to ponding; slope; susceptibility to flooding; subsidence of organic layers; and potential frost action. Excavating and grading and the stability of ditchbanks are affected by depth to bedrock, large stones, slope, and the hazard of cutbanks caving. The productivity of the soil after drainage is adversely affected by extreme acidity. Availability of drainage outlets is not considered in the ratings.

Terraces and diversions are embankments or a combination of channels and ridges constructed across a slope to reduce erosion and conserve moisture by intercepting runoff. Slope, wetness, large stones, and depth to bedrock affect the construction of terraces and diversions. A restricted rooting depth, a severe hazard of wind or water erosion, an excessively coarse texture, and restricted permeability adversely affect maintenance.

Grassed waterways are natural or constructed channels, generally broad and shallow, that conduct surface water to outlets at a nonerosive velocity. Large stones, wetness, slope, and depth to bedrock affect the construction of grassed waterways. A hazard of wind erosion, low available water capacity, restricted rooting depth, and restricted permeability adversely affect the growth and maintenance of the grass after construction.

Soil Properties

Data relating to soil properties are collected during the course of the soil survey. The data and the estimates of soil and water features, listed in tables, are explained on the following pages.

Soil properties are determined by field examination of the soils and by laboratory index testing of some benchmark soils. Established standard procedures are followed. During the survey, many shallow borings are made and examined to identify and classify the soils and to delineate them on the soil maps. Samples are taken from some typical profiles and tested in the laboratory to determine grain-size distribution, plasticity, and compaction characteristics.

Estimates of soil properties are based on field examinations, on laboratory tests of samples from the survey area, and on laboratory tests of samples of similar soils in nearby areas. Tests verify field observations, verify properties that cannot be estimated accurately by field observation, and help characterize key soils.

The estimates of soil properties shown in the tables include the range of grain-size distribution and Atterberg limits, the engineering classifications, and the physical and chemical properties of the major layers of each soil. Pertinent soil and water features also are given.

Engineering Index Properties

Table 15 gives estimates of the engineering classification and of the range of index properties for the major layers of each soil in the survey area. Most soils have layers of contrasting properties within the upper 5 or 6 feet.

Depth to the upper and lower boundaries of each layer is indicated. The range in depth and information on other properties of each layer are given for each soil series under "Soil Series and Their Morphology."

Texture is given in the standard terms used by the U.S. Department of Agriculture. These terms are defined according to percentages of sand, silt, and clay in the fraction of the soil that is less than 2 millimeters in diameter. "Loam," for example, is soil that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If the content of particles coarser than sand is as much as about 15 percent, an appropriate modifier is added, for example, "gravelly." Textural terms are defined in the Glossary.

Classification of the soils is determined according to the Unified soil classification system (*3*) and the system adopted by the American Association of State Highway and Transportation Officials (*2*).

The Unified system classifies soils according to properties that affect their use as construction material. Soils are classified according to grain-size distribution of the fraction less than 3 inches in diameter and according to plasticity index, liquid limit, and organic matter content. Sandy and gravelly soils are identified as GW, GP, GM, GC, SW, SP, SM, and SC; silty and clayey soils as ML, CL, OL, MH, CH, and OH; and highly organic soils as PT. Soils exhibiting engineering properties of two groups can have a dual classification, for example, CL-ML.

The AASHTO system classifies soils according to those properties that affect roadway construction and maintenance. In this system, the fraction of a mineral soil that is less than 3 inches in diameter is classified in one of seven groups from A-1 through A-7 on the basis of grain-size distribution, liquid limit, and plasticity index. Soils in group A-1 are coarse grained and low in content of fines (silt and clay). At the other extreme, soils in group A-7 are fine grained. Highly organic soils are classified in group A-8 on the basis of visual inspection.

If laboratory data are available, the A-1, A-2, and A-7 groups are further classified as A-1-a, A-1-b, A-2-4, A-2-5, A-2-6, A-2-7, A-7-5, or A-7-6. As an additional refinement, the suitability of a soil as subgrade material can be indicated by a group index number. Group index numbers range from 0 for the best subgrade material to 20 or higher for the poorest.

Rock fragments larger than 3 inches in diameter are indicated as a percentage of the total soil on a dry-weight basis. The percentages are estimates determined mainly by converting volume percentage in the field to weight percentage.

Percentage (of soil particles) passing designated sieves is the percentage of the soil fraction less than 3 inches in diameter based on an ovendry weight. The sieves, numbers 4, 10, 40, and 200 (USA Standard Series), have openings of 4.76, 2.00, 0.420, and 0.074 millimeters, respectively. Estimates are based on laboratory tests of soils sampled in the survey area and in nearby areas and on estimates made in the field.

Liquid limit and *plasticity index* (Atterberg limits) indicate the plasticity characteristics of a soil. The

estimates are based on test data from the survey area or from nearby areas and on field examination.

The estimates of grain-size distribution, liquid limit, and plasticity index are generally rounded to the nearest 5 percent. Thus, if the ranges of gradation and Atterberg limits extend a marginal amount (1 or 2 percentage points) across classification boundaries, the classification in the marginal zone is omitted in the table.

Physical and Chemical Properties

Table 16 shows estimates of some characteristics and features that affect soil behavior. These estimates are given for the major layers of each soil in the survey area. The estimates are based on field observations and on test data for these and similar soils.

Clay as a soil separate consists of mineral soil particles that are less than 0.002 millimeter in diameter. In this table, the estimated clay content of each major soil layer is given as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The amount and kind of clay greatly affect the fertility and physical condition of the soil. They determine the ability of the soil to adsorb cations and to retain moisture. They influence shrink-swell potential, permeability, and plasticity, the ease of soil dispersion, and other soil properties. The amount and kind of clay in a soil also affect tillage and earthmoving operations.

Moist bulk density is the weight of soil (ovendry) per unit volume. Volume is measured when the soil is at field moisture capacity, that is, the moisture content at 1/3 bar moisture tension. Weight is determined after drying the soil at 105 degrees C. In this table, the estimated moist bulk density of each major soil horizon is expressed in grams per cubic centimeter of soil material that is less than 2 millimeters in diameter. Bulk density data are used to compute shrink-swell potential, available water capacity, total pore space, and other soil properties. The moist bulk density of a soil indicates the pore space available for water and roots. A bulk density of more than 1.6 can restrict water storage and root penetration. Moist bulk density is influenced by texture, kind of clay, content of organic matter, and soil structure.

Permeability refers to the ability of a soil to transmit water or air. The estimates indicate the rate of downward movement of water when the soil is saturated. They are based on soil characteristics observed in the field, particularly structure, porosity, and texture. Permeability is considered in the design of soil drainage systems, septic tank absorption fields, and construction where the rate of water movement under saturated conditions affects behavior.

Available water capacity refers to the quantity of water that the soil is capable of storing for use by plants. The capacity for water storage is given in inches of water per inch of soil for each major soil layer. The capacity varies, depending on soil properties that affect the retention of water and the depth of the root zone. The most important properties are the content of organic matter, soil texture, bulk density, and soil structure. Available water capacity is an important factor in the choice of plants or crops to be grown and in the design and management of irrigation systems. Available water capacity is not an estimate of the quantity of water actually available to plants at any given time.

Soil reaction is a measure of acidity or alkalinity and is expressed as a range in pH values. The range in pH of each major horizon is based on many field tests. For many soils, values have been verified by laboratory analyses. Soil reaction is important in selecting crops and other plants, in evaluating soil amendments for fertility and stabilization, and in determining the risk of corrosion.

Shrink-swell potential is the potential for volume change in a soil with a loss or gain in moisture. Volume change occurs mainly because of the interaction of clay minerals with water and varies with the amount and type of clay minerals in the soil. The size of the load on the soil and the magnitude of the change in soil moisture content influence the amount of swelling of soils in place. Laboratory measurements of swelling of undisturbed clods were made for many soils. For others, swelling was estimated on the basis of the kind and amount of clay minerals in the soil and on measurements of similar soils.

If the shrink-swell potential is rated moderate to very high, shrinking and swelling can cause damage to buildings, roads, and other structures. Special design is often needed.

Shrink-swell potential classes are based on the change in length of an unconfined clod as moisture content is increased from air-dry to field capacity. The change is based on the soil fraction less than 2 millimeters in diameter. The classes are *low*, a change of less than 3 percent; *moderate*, 3 to 6 percent; and *high*, more than 6 percent. *Very high*, greater than 9 percent, is sometimes used.

Erosion factor K indicates the susceptibility of a soil to sheet and rill erosion by water. Factor K is one of six factors used in the Universal Soil Loss Equation (USLE) to predict the average annual rate of soil loss by sheet and rill erosion in tons per acre per year. The estimates are based primarily on percentage of silt, sand, and organic matter (up to 4 percent) and on soil structure and permeability. Values of K range from 0.05 to 0.69. The higher the value, the more susceptible the soil is to sheet and rill erosion by water.

Erosion factor T is an estimate of the maximum average annual rate of soil erosion by wind or water that can occur without affecting crop productivity over a sustained period. The rate is in tons per acre per year.

Wind erodibility groups are made up of soils that have similar properties affecting their resistance to wind erosion in cultivated areas. The groups indicate the

susceptibility of soil to wind erosion. Soils are grouped according to the following distinctions:

1. Sands, coarse sands, fine sands, and very fine sands. These soils are generally not suitable for crops. They are extremely erodible, and vegetation is difficult to establish.

2. Loamy sands, loamy fine sands, and loamy very fine sands. These soils are very highly erodible. Crops can be grown if intensive measures to control wind erosion are used.

3. Sandy loams, coarse sandy loams, fine sandy loams, and very fine sandy loams. These soils are highly erodible. Crops can be grown if intensive measures to control wind erosion are used.

4L. Calcareous loamy soils that are less than 35 percent clay and more than 5 percent finely divided calcium carbonate. These soils are erodible. Crops can be grown if intensive measures to control wind erosion are used.

4. Clays, silty clays, clay loams, and silty clay loams that are more than 35 percent clay. These soils are moderately erodible. Crops can be grown if measures to control wind erosion are used.

5. Loamy soils that are less than 18 percent clay and less than 5 percent finely divided calcium carbonate and sandy clay loams and sandy clays that are less than 5 percent finely divided calcium carbonate. These soils are slightly erodible. Crops can be grown if measures to control wind erosion are used.

6. Loamy soils that are 18 to 35 percent clay and less than 5 percent finely divided calcium carbonate, except silty clay loams. These soils are very slightly erodible. Crops can easily be grown.

7. Silty clay loams that are less than 35 percent clay and less than 5 percent finely divided calcium carbonate. These soils are very slightly erodible. Crops can easily be grown.

8. Stony or gravelly soils and other soils not subject to wind erosion.

Soil and Water Features

Table 17 gives estimates of various soil and water features. The estimates are used in land use planning that involves engineering considerations.

Hydrologic soil groups are used to estimate runoff from precipitation. Soils not protected by vegetation are assigned to one of four groups. They are grouped according to the intake of water when the soils are thoroughly wet and receive precipitation from long-duration storms.

The four hydrologic soil groups are:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a permanent high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to two hydrologic groups in table 17, the first letter is for drained areas and the second is for undrained areas.

Flooding, the temporary inundation of an area, is caused by overflowing streams and by runoff from adjacent slopes. Water standing for short periods after rainfall or snowmelt is not considered flooding, nor is water in swamps and marshes.

Table 17 gives the frequency and duration of flooding and the time of year when flooding is most likely.

Frequency, duration, and probable dates of occurrence are estimated. Frequency is expressed as none, rare, occasional, and frequent. *None* means that flooding is not probable; *rare* that it is unlikely but possible under unusual weather conditions; *occasional* that it occurs, on the average, once or less in 2 years; and *frequent* that it occurs, on the average, more than once in 2 years. Duration is expressed as *very brief* if less than 2 days, *brief* if 2 to 7 days, and *long* if more than 7 days. Probable dates are expressed in months; November-May, for example, means that flooding can occur during the period November through May.

The information is based on evidence in the soil profile, namely thin strata of gravel, sand, silt, or clay deposited by floodwater; irregular decrease in organic matter content with increasing depth; and absence of distinctive horizons that form in soils that are not subject to flooding.

Also considered are local information about the extent and levels of flooding and the relation of each soil on the landscape to historic floods. Information on the extent of flooding based on soil data is less specific than that provided by detailed engineering surveys that delineate flood-prone areas at specific flood frequency levels.

High water table (seasonal) is the highest level of a saturated zone in the soil in most years. The depth to a seasonal high water table applies to undrained soils. The estimates are based mainly on the evidence of a

saturated zone, namely grayish colors or mottles in the soil. Indicated in table 17 are the depth to the seasonal high water table; the kind of water table—that is, perched or apparent; and the months of the year that the water table commonly is high. A water table that is seasonally high for less than 1 month is not indicated in table 17.

An *apparent* water table is a thick zone of free water in the soil. It is indicated by the level at which water stands in an uncased borehole after adequate time is allowed for adjustment in the surrounding soil. A *perched* water table is water standing above an unsaturated zone. In places an upper, or perched, water table is separated from a lower one by a dry zone.

Only saturated zones within a depth of about 6 feet are indicated. A plus sign preceding the range in depth indicates that the water table is above the surface of the soil. The first numeral in the range indicates how high the water rises above the surface. The second numeral indicates the depth below the surface.

Depth to bedrock is given if bedrock is within a depth of 5 feet. The depth is based on many soil borings and on observations during soil mapping. The rock is either soft or hard. If the rock is soft or fractured, excavations can be made with trenching machines, backhoes, or small rippers. If the rock is hard or massive, blasting or special equipment generally is needed for excavation.

Risk of corrosion pertains to potential soil-induced electrochemical or chemical action that dissolves or weakens uncoated steel or concrete. The rate of corrosion of uncoated steel is related to such factors as soil moisture, particle-size distribution, acidity, and electrical conductivity of the soil. The rate of corrosion of concrete is based mainly on the sulfate and sodium content, texture, moisture content, and acidity of the soil. Special site examination and design may be needed if the combination of factors creates a severe corrosion environment. The steel in installations that intersect soil boundaries or soil layers is more susceptible to corrosion than steel in installations that are entirely within one kind of soil or within one soil layer.

For uncoated steel, the risk of corrosion, expressed as *low*, *moderate*, or *high*, is based on soil drainage class, total acidity, electrical resistivity near field capacity, and electrical conductivity of the saturation extract.

For concrete, the risk of corrosion is also expressed as *low*, *moderate*, or *high*. It is based on soil texture, acidity, and amount of sulfates in the saturation extract.

Classification of the Soils

The system of soil classification used by the National Cooperative Soil Survey has six categories (*23*). Beginning with the broadest, these categories are the order, suborder, great group, subgroup, family, and series. Classification is based on soil properties observed in the field or inferred from those observations or from laboratory measurements. Table 18 shows the classification of the soils in the survey area. The categories are defined in the following paragraphs.

ORDER. Ten soil orders are recognized. The differences among orders reflect the dominant soil-forming processes and the degree of soil formation. Each order is identified by a word ending in *sol.* An example is Alfisol.

SUBORDER. Each order is divided into suborders primarily on the basis of properties that influence soil genesis and are important to plant growth or properties that reflect the most important variables within the orders. The last syllable in the name of a suborder indicates the order. An example is Udalf (*Ud*, meaning humid, plus *alf*, from Alfisol).

GREAT GROUP. Each suborder is divided into great groups on the basis of close similarities in kind, arrangement, and degree of development of pedogenic horizons; soil moisture and temperature regimes; and base status. Each great group is identified by the name of a suborder and by a prefix that indicates a property of the soil. An example is Hapludalfs (*Hapl*, meaning minimal horizonation, plus *udalf*, the suborder of the Alfisols that have a udic moisture regime).

SUBGROUP. Each great group has a typic subgroup. Other subgroups are intergrades or extragrades. The typic is the central concept of the great group; it is not necessarily the most extensive. Intergrades are transitions to other orders, suborders, or great groups. Extragrades have some properties that are not representative of the great group but do not indicate transitions to any other known kind of soil. Each subgroup is identified by one or more adjectives preceding the name of the great group. The adjective *Typic* identifies the subgroup that typifies the great group. An example is Typic Hapludalfs.

FAMILY. Families are established within a subgroup on the basis of physical and chemical properties and other characteristics that affect management. Mostly the properties are those of horizons below plow depth where there is much biological activity. Among the properties and characteristics considered are particle-size class, mineral content, temperature regime, depth of the root zone, consistence, moisture equivalent, slope, and permanent cracks. A family name consists of the name of a subgroup preceded by terms that indicate soil properties. An example is fine, montmorillonitic, mesic Typic Hapludalfs.

SERIES. The series consists of soils that have similar horizons in their profile. The horizons are similar in color, texture, structure, reaction, consistence, mineral and chemical composition, and arrangement in the profile. The texture of the surface layer or of the substratum can differ within a series.

Soil Series and Their Morphology

In this section, each soil series recognized in the survey area is described. The descriptions are arranged in alphabetic order.

Characteristics of the soil and the material in which it formed are identified for each series. A pedon, a small three-dimensional area of soil, that is typical of the series in the survey area is described. The detailed description of each soil horizon follows standards in the *Soil Survey Manual* (*22*). Many of the technical terms used in the descriptions are defined in *Soil Taxonomy* (*23*). Unless otherwise stated, colors in the descriptions are for moist soil. Following the pedon description is the range of important characteristics of the soils in the series.

The map units of each soil series are described in the section "Detailed Soil Map Units."

Ackmore Series

The Ackmore series consists of somewhat poorly drained, moderately permeable soils along the major streams and in upland drainageways. These soils formed in stratified alluvium over a dark buried soil. Slopes range from 0 to 5 percent.

Typical pedon of Ackmore silt loam, 0 to 2 percent slopes, in a cultivated field; 500 feet north and 70 feet west of the southeast corner of sec. 27, T. 75 N., R. 6 W.

Ap—0 to 8 inches; dark grayish brown (10YR 4/2) silt loam, light brownish gray (10YR 6/2) dry; few very dark grayish brown (10YR 3/2) coatings on faces of

peds; moderate fine granular structure; friable; medium acid; abrupt smooth boundary.

C1—8 to 16 inches; stratified dark grayish brown (10YR 4/2), very dark gray (10YR 3/1), brown (10YR 5/3), and very dark grayish brown (10YR 3/2) silt loam; few fine distinct strong brown (7.5YR 4/6) mottles; moderate medium platy structure; friable; medium acid; gradual smooth boundary.

C2—16 to 26 inches; stratified very dark gray (10YR 3/1), dark grayish brown (10YR 4/2), brown (10YR 5/3), and very dark grayish brown (10YR 3/2) silt loam; weak medium platy structure parting to weak fine subangular blocky; friable; slightly acid; clear smooth boundary.

2Ab1—26 to 31 inches; black (N 2/0) silty clay loam; weak fine subangular blocky structure parting to weak fine granular; friable; medium acid; gradual smooth boundary.

2Ab2—31 to 38 inches; black (N 2/0) silty clay loam; weak medium prismatic structure parting to moderate medium subangular blocky; firm; medium acid; gradual smooth boundary.

2Ab3—38 to 60 inches; very dark gray (N 3/0) silty clay loam; moderate medium prismatic structure; firm; sheen on faces of peds; medium acid.

The depth to the 2Ab horizon is 20 to 36 inches. The Ap horizon has hue of 10YR, value of 2 to 4, and chroma of 1 or 2. The C horizon has strata ranging from black (10YR 2/1) to grayish brown (10YR 5/2). It typically is silt loam and less commonly is silty clay loam. The A and C horizons range from neutral to medium acid. The 2Ab horizon is black (N 2/0 or 10YR 2/1) or very dark gray (N 3/0 or 10YR 3/1). It typically is silty clay loam but in some pedons is silt loam. It has a clay content of 26 to 38 percent. It ranges from medium acid to mildly alkaline.

Adair Series

The Adair series consists of somewhat poorly drained, slowly permeable soils on convex side slopes. These soils generally occur as bands on uplands above soils that formed in glacial till and below soils that formed in silty loess. They formed in a thin mantle of loess and a Late Sangamon paleosol that formed in glacial till. The native vegetation was mixed prairie grasses. Slopes range from 5 to 14 percent.

Typical pedon of Adair silty clay loam, 9 to 14 percent slopes, moderately eroded, in a cultivated field; 300 feet north and 63 feet west of the southeast corner of sec. 8, T. 75 N., R. 6 W.

Ap—0 to 10 inches; very dark grayish brown (10YR 3/2) silty clay loam, grayish brown (10YR 5/2) dry; mixed with streaks and pockets of brown (7.5YR 4/4) silty clay subsoil material; black (10YR 2/1) coatings on faces of peds; weak fine granular structure; friable; few pebbles and stones at the base of the horizon; neutral; abrupt smooth boundary.

2Bt1—10 to 14 inches; brown (7.5YR 4/4) silty clay; few very dark grayish brown (10YR 3/2) coatings on faces of peds; few fine distinct dark reddish brown (5YR 3/4) mottles; weak fine subangular blocky structure parting to moderate fine granular; friable; thin discontinuous clay films on faces of peds; medium acid; gradual smooth boundary.

2Bt2—14 to 24 inches; grayish brown (2.5Y 5/2), dark yellowish brown (10YR 4/6), and red (2.5YR 4/6) clay; moderate medium and fine subangular blocky structure; very firm; thin nearly continuous clay films on faces of peds; about 2 percent pebbles; medium acid; gradual smooth boundary.

2Bt3—24 to 35 inches; light brownish gray (2.5Y 6/2) clay loam; common fine prominent strong brown (7.5YR 5/8) mottles; weak medium prismatic structure parting to moderate medium subangular blocky; firm; thin nearly continuous clay films on faces of peds; about 5 percent pebbles; medium acid; gradual smooth boundary.

2BC—35 to 54 inches; light brownish gray (2.5Y 6/2) clay loam; common fine prominent strong brown (7.5YR 5/8) mottles; weak coarse prismatic structure; firm; dark grayish brown (10YR 4/2) clay flows in root channels; many large dark concretions (manganese oxides); about 5 percent pebbles; slightly acid; gradual smooth boundary.

2C—54 to 60 inches; yellowish brown (10YR 5/6) clay loam; common medium prominent light brownish gray (2.5Y 6/2) mottles; massive; many large dark concretions (manganese oxides); about 5 percent pebbles; slightly acid.

The solum ranges from 40 to 65 inches in thickness. The A or Ap horizon has hue of 10YR, value of 2 or 3, and chroma of 1 or 2. The A horizon is silty clay loam, clay loam, or loam. The upper part of the 2Bt horizon has a clay content of 38 to 50 percent. It generally has hue of 7.5YR to 2.5Y, value of 4 to 6, and chroma of 2 to 4, but it also has hue of 2.5YR to 10YR, value of 3 to 5, and chroma of 3 to 6 either in part of the matrix or in many prominent mottles. The lower part of the 2Bt horizon has hue of 2.5Y or 10YR, value of 4 to 6, and chroma of 2 to 6. The 2Bt horizon is medium acid or strongly acid. The 2C horizon has hue of 10YR, value of 4 or 5, and chroma of 4 to 6.

The Adair soil in the map unit Shelby-Adair clay loams, 9 to 14 percent slopes, severely eroded, is a taxadjunct to the Adair series because it does not have a mollic epipedon.

Ainsworth Series

The Ainsworth series consists of moderately well drained soils on stream terraces. These soils formed in

silty alluvial sediments and in the underlying sandy sediments. The native vegetation was deciduous trees. Permeability is moderately slow in the upper part of the profile and rapid in the lower part. Slopes range from 1 to 5 percent.

Typical pedon of Ainsworth silt loam, 1 to 5 percent slopes, in a cultivated field; 1,570 feet east and 1,100 feet north of the southwest corner of sec. 27, T. 74 N., R. 6 W.

Ap—0 to 9 inches; dark grayish brown (10YR 4/2) and brown (10YR 4/3) silt loam (20 percent clay), light brownish gray (10YR 6/2) and pale brown (10YR 6/3) dry; weak fine granular structure; friable; weak platy structure in the lowest 1 inch; slightly acid; abrupt smooth boundary.

Bt1—9 to 18 inches; dark yellowish brown (10YR 4/4) and brown (10YR 4/3) silty clay loam (36 percent clay); moderate fine subangular blocky structure; firm; few thin discontinuous clay films on faces of peds; thin nearly continuous light gray (10YR 7/2) dry silt coatings on faces of peds; few small dark accumulations (iron and manganese oxides); slightly acid; gradual smooth boundary.

Bt2—18 to 29 inches; yellowish brown (10YR 5/4) and brown (10YR 4/3) silty clay loam (38 percent clay); moderate medium subangular blocky structure; firm; thin discontinuous clay films on faces of peds; thin nearly continuous light gray (10YR 7/2) dry silt coatings on faces of peds; few small dark accumulations (iron and manganese oxides); medium acid; gradual smooth boundary.

Bt3—29 to 37 inches; yellowish brown (10YR 5/4) and brown (10YR 4/3) silty clay loam (38 percent clay); weak fine prismatic structure parting to weak fine subangular blocky; friable; thin discontinuous clay films on faces of peds; thin discontinuous light gray (10YR 7/2) dry silt coatings on faces of peds; few small dark accumulations (iron and manganese oxides); very strongly acid; gradual smooth boundary.

Bt4—37 to 43 inches; yellowish brown (10YR 5/4) and brown (10YR 4/3 and 5/3) silty clay loam (28 percent clay); few fine faint light brownish gray (10YR 6/2) and few medium distinct strong brown (7.5YR 4/6) mottles; weak medium prismatic structure; friable; thin discontinuous clay films on faces of peds; thin discontinuous light gray (10YR 7/2) dry silt coatings on faces of peds; few small dark accumulations (iron and manganese oxides); noticeable increase in fine sand content; very strongly acid; gradual smooth boundary.

2BC—43 to 48 inches; yellowish brown (10YR 5/4) sandy loam; weak medium prismatic structure; friable; very strongly acid; gradual smooth boundary.

2C—48 to 60 inches; yellowish brown (10YR 5/4) loamy sand; single grained; loose; very strongly acid.

The solum ranges from 40 to 60 inches in thickness. It is slightly acid to very strongly acid.

The Ap horizon is 6 to 9 inches thick. It is dark grayish brown (10YR 4/2) or brown (10YR 4/3). It is dominantly silt loam. In some moderately eroded areas, however, it is silty clay loam. Some pedons have an E horizon, which is 2 to 4 inches thick. The Bt horizon has a clay content of 28 to 38 percent. The lower part of the solum is sandy clay loam, loam, or sandy loam.

Amana Series

The Amana series consists of somewhat poorly drained, moderately permeable soils on flood plains, typically adjacent to remnants of former stream meanders and natural levees. These soils formed in silty alluvium. The native vegetation was mixed prairie grasses. Slopes range from 0 to 2 percent.

Typical pedon of Amana silt loam, 0 to 2 percent slopes, in a cultivated field; 500 feet west and 1,280 feet south of the northeast corner of sec. 24, T. 74 N., R. 7 W.

Ap—0 to 10 inches; black (10YR 2/1) silt loam, dark gray (10YR 4/1) dry; weak fine granular structure; friable; medium acid; abrupt smooth boundary.

A—10 to 16 inches; very dark gray (10YR 3/1) silt loam, gray (10YR 5/1) dry; few fine faint dark grayish brown (10YR 4/2) mottles; weak medium subangular blocky structure parting to weak fine granular; friable; medium acid; gradual smooth boundary.

Bw1—16 to 23 inches; dark grayish brown (10YR 4/2) and grayish brown (10YR 5/2) silt loam; few fine distinct yellowish brown (10YR 5/6) mottles; weak fine subangular blocky structure; friable; common light gray (10YR 7/2) dry silt coatings on faces of peds; strongly acid; gradual smooth boundary.

Bw2—23 to 34 inches; grayish brown (10YR 5/2) silt loam; common fine distinct yellowish brown (10YR 5/6) mottles; weak fine subangular blocky structure; friable; many light gray (10YR 7/2) dry silt coatings on faces of peds; few soft dark accumulations (iron and manganese oxides); strongly acid; gradual smooth boundary.

BC—34 to 48 inches; grayish brown (10YR 5/2) and dark grayish brown (10YR 4/2) silt loam; many fine distinct yellowish brown (10YR 5/6) and strong brown (7.5YR 5/8) mottles; weak fine subangular blocky structure; friable; common white (10YR 8/1) dry silt coatings on faces of peds; few soft dark accumulations (iron and manganese oxides); strongly acid; gradual smooth boundary.

C—48 to 60 inches; grayish brown (10YR 5/2) and dark grayish brown (10YR 4/2) silt loam; many fine faint yellowish brown (10YR 5/6) and strong brown (7.5YR 5/6) mottles; massive; friable; common white

(10YR 8/1) dry silt coatings on faces of peds; medium acid.

The solum ranges from 30 to 65 inches in thickness. The subsoil typically is medium acid or strongly acid.

The A horizon is black (10YR 2/1), very dark brown (10YR 2/2), or very dark gray (10YR 3/1). It is silt loam or silty clay loam and is 10 to 20 inches thick. The Bw horizon has a clay content of about 25 to 30 percent. It has hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 2. It typically has mottles with value of 4 or 5 and chroma of 3 to 8. The C horizon has hue of 10YR to 5Y, value of 4 to 6, and chroma of 1 or 2.

Armstrong Series

The Armstrong series consists of somewhat poorly drained, slowly permeable soils on convex side slopes in the highly dissected uplands. These soils are at the contact between loess and glacial till. They formed in a thin mantle of loamy sediments and a Late Sangamon paleosol that formed in glacial till. The native vegetation was mixed prairie grasses and deciduous trees. Slopes range from 5 to 18 percent.

Typical pedon of Armstrong silt loam, 5 to 9 percent slopes, moderately eroded, in a hayfield; 800 feet east and 130 feet north of the southwest corner of sec. 33, T. 74 N., R. 9 W.

Ap—0 to 8 inches; dark brown (10YR 3/3) silt loam, brown (10YR 5/3) dry; mixed with streaks and pockets of brown (7.5YR 4/4) and yellowish red (5YR 4/6) clay loam subsoil material; weak fine granular structure; friable; slightly acid; abrupt smooth boundary.

2Bt1—8 to 14 inches; yellowish red (5YR 4/6) clay loam; moderate medium subangular blocky structure; firm; thin discontinuous brown (10YR 5/3) clay films on faces of peds; few pebbles and stones at the base of the horizon; medium acid; gradual smooth boundary.

2Bt2—14 to 24 inches; brown (7.5YR 4/4) clay; many fine prominent red (2.5YR 4/6) and dark red (2.5YR 3/6) and common fine prominent dark grayish brown (2.5Y 4/2) mottles; moderate fine subangular blocky structure; firm; about 5 percent pebbles; medium acid; gradual smooth boundary.

2Bt3—24 to 35 inches; strong brown (7.5YR 5/6) clay loam; common fine prominent dark red (2.5YR 3/6) and few fine prominent grayish brown (2.5Y 5/2) and light brownish gray (2.5Y 6/2) mottles; weak medium subangular blocky structure; firm; thin discontinuous clay films on faces of peds; about 5 percent pebbles; medium acid; gradual smooth boundary.

2Bt4—35 to 45 inches; strong brown (7.5YR 5/6) clay loam; few fine prominent grayish brown (2.5Y 5/2) mottles; moderate medium prismatic structure parting to moderate medium subangular blocky; firm; thin nearly continuous dark red (2.5YR 3/6) and reddish brown (5YR 4/4) clay films on faces of peds; about 5 percent pebbles; slightly acid; gradual smooth boundary.

2BC—45 to 60 inches; yellowish brown (10YR 5/6) clay loam; few fine prominent grayish brown (2.5Y 5/2) mottles; weak medium prismatic structure; firm; about 5 percent pebbles; neutral.

The solum ranges from 42 to 80 inches in thickness. The Ap horizon is loam, silt loam, or clay loam. It has hue of 10YR, value of 3, and chroma of 1 to 3. In most pedons the E horizon has been destroyed by cultivation or erosion and is evidenced only by silt coatings on the faces of peds in the Ap horizon. The 2Bt horizon has hue of 5YR, 7.5YR, or 10YR, value of 4 or 5, and chroma of 3 to 6. If hue is 10YR or 7.5YR, this horizon has mottles with hue of 5YR or redder, value of 3 to 8, and chroma of 3 to 6. It has a clay content of 36 to 48 percent. It is slightly acid to very strongly acid. The 2BC horizon has hue of 10YR, value of 4 or 5, and chroma of 3 to 6 and has few or common mottles with chroma of 2 or less.

The Armstrong soil in the map unit Gara-Armstrong clay loams, 9 to 14 percent slopes, severely eroded, is a taxadjunct to the Armstrong series because the surface layer has too light a value for the soil to qualify as a Mollic Hapludalf.

Ashgrove Series

The Ashgrove series consists of poorly drained, very slowly permeable soils on convex side slopes and in coves at the head of drainageways in the uplands. These soils formed in a thin mantle of loess over a gray, clayey paleosol that formed in glacial till. The native vegetation was deciduous trees. Slopes range from 9 to 14 percent.

Typical pedon of Ashgrove silt loam, 9 to 14 percent slopes, moderately eroded, in a hayfield; 850 feet north and 307 feet west of the southeast corner of sec. 12, T. 76 N., R. 6 W.

Ap—0 to 6 inches; dark grayish brown (10YR 4/2) silt loam, light brownish gray (10YR 6/2) dry; mixed with streaks and pockets of brown (10YR 5/3) silty clay loam subsoil material; weak fine granular structure; friable; light gray (10YR 7/2) dry silt coatings on faces of peds; few soft reddish brown (5YR 4/4) accumulations (iron and manganese oxides); slightly acid; abrupt smooth boundary.

2Bt—6 to 15 inches; dark grayish brown (10YR 4/2) and brown (10YR 5/3) silty clay loam; few fine faint yellowish brown (10YR 5/4 and 5/6) mottles; weak fine subangular blocky structure; firm; thin discontinuous gray (10YR 5/1) clay films on faces of

peds; few soft reddish brown (5YR 4/4) accumulations (iron and manganese oxides); some sand grains; strongly acid; clear smooth boundary.

2Btg1—15 to 22 inches; grayish brown (10YR 5/2) silty clay; few fine faint yellowish brown (10YR 5/6) and few fine distinct strong brown (7.5YR 5/6) mottles; moderate fine subangular blocky structure; firm; thin discontinuous gray (10YR 5/1) clay films on faces of peds; common dark brown (10YR 3/3) accumulations (iron and manganese oxides); medium acid; clear smooth boundary.

2Btg2—22 to 28 inches; grayish brown (10YR 5/2) silty clay; gray (10YR 5/1) coatings on faces of peds; few fine faint yellowish brown (10YR 5/6) and few fine distinct strong brown (7.5YR 5/6) mottles; moderate fine and medium subangular blocky structure; firm; thin nearly continuous gray (10YR 5/1) clay films on faces of peds; black clay flows at a depth of 25 to 27 inches; few dark brown (10YR 3/3) accumulations (iron and manganese oxides); medium acid; clear smooth boundary.

2Btg3—28 to 34 inches; grayish brown (10YR 5/2) silty clay; gray (10YR 5/1) coatings on faces of peds; few fine faint yellowish brown (10YR 5/6) and few fine distinct strong brown (7.5YR 5/6) mottles; weak medium subangular blocky structure; firm; thin discontinuous gray (10YR 5/1) clay films on faces of peds; few reddish brown (5YR 4/4) accumulations (iron and manganese oxides); neutral; clear smooth boundary.

2Btg4—34 to 42 inches; gray (10YR 5/1) silty clay; few fine faint yellowish brown (10YR 5/6) mottles; weak medium subangular blocky structure; firm; thin discontinuous gray (10YR 5/1) clay films on faces of peds; few dark reddish brown (5YR 4/4) accumulations (iron and manganese oxides); common fine and medium sand grains; neutral; gradual smooth boundary.

2Btg5—42 to 52 inches; gray (10YR 5/1) and light brownish gray (10YR 6/2) silty clay; few fine faint yellowish brown (10YR 5/6) mottles; weak medium prismatic structure; firm; thin discontinuous gray (10YR 5/1) clay films on faces of peds; few reddish brown (5YR 4/4) accumulations (iron and manganese oxides); common fine and medium sand grains; neutral; gradual smooth boundary.

2Cg—52 to 60 inches; gray (10YR 5/1) and light brownish gray (10YR 6/2) silty clay; few fine faint yellowish brown (10YR 5/6) and few fine distinct strong brown (7.5YR 5/6) mottles; massive; firm; few dark brown (10YR 3/3) accumulations (iron and manganese oxides); few calcium carbonate accumulations; neutral.

The solum ranges from 42 to 84 inches in thickness. The Ap or A horizon has hue of 10YR, value of 3 or 4, and chroma of 1 to 3. Some pedons have an E horizon. This horizon is grayish brown (10YR 5/2) or brown (10YR 5/3). The A and E horizons are silt loam or silty clay loam. The 2Bt horizon has hue of 10YR, value of 4 or 5, and chroma of 2 to 4. The distinctly gleyed part of the 2Btg horizon has hue of 10YR, 2.5Y, or 5Y, value of 4 to 6, and chroma of 1 to 3. The lower part of the 2Btg horizon has a clay content of 45 to 60 percent. This horizon is neutral to very strongly acid.

Bertrand Series

The Bertrand series consists of well drained soils on low stream terraces. These soils formed in silty and loamy alluvium. The native vegetation was deciduous trees. Permeability is moderate in the upper part of the profile and moderately rapid in the lower part. Slopes range from 1 to 5 percent.

Typical pedon of Bertrand silt loam, 1 to 5 percent slopes, in a timbered area; 900 feet south and 1,420 feet west of the center of sec. 15, T. 77 N., R. 7 W.

A—0 to 4 inches; very dark grayish brown (10YR 3/2) silt loam (19 percent clay), dark grayish brown (10YR 4/2) dry; weak fine granular structure; friable; neutral; clear smooth boundary.

E—4 to 8 inches; dark grayish brown (10YR 4/2) and brown (10YR 4/3) silt loam (17 percent clay), light brownish gray (10YR 6/2) dry; moderate medium platy structure; friable; medium acid; clear smooth boundary.

Bt1—8 to 16 inches; dark yellowish brown (10YR 4/4) silt loam (24 percent clay); weak fine subangular blocky structure; friable; thin discontinuous brown (10YR 4/3) clay films on faces of peds; thin discontinuous light gray (10YR 7/2) dry silt coatings on faces of peds; medium acid; gradual smooth boundary.

Bt2—16 to 29 inches; dark yellowish brown (10YR 4/4) silty clay loam (27 percent clay); moderate fine subangular blocky structure; friable; thin nearly continuous brown (10YR 4/3) clay films on faces of peds; thin discontinuous light gray (10YR 7/2) dry silt coatings on faces of peds; medium acid; gradual smooth boundary.

Bt3—29 to 42 inches; dark yellowish brown (10YR 4/4) silty clay loam (28 percent clay); weak fine prismatic structure parting to moderate medium subangular blocky; friable; thin nearly continuous brown (10YR 4/3) clay films on faces of peds; thin nearly continuous light gray (10YR 7/2) dry silt coatings on faces of peds; medium acid; gradual smooth boundary.

2Bt4—42 to 52 inches; dark yellowish brown (10YR 4/4) loam (22 percent clay); few fine faint brown (7.5YR 4/4) and strong brown (7.5YR 4/6) mottles; weak fine prismatic structure parting to moderate medium and coarse subangular blocky; friable; thin

discontinuous brown (10YR 4/3) clay films on faces of peds; thin nearly continuous light gray (10YR 7/2) dry silt coatings on faces of peds; medium acid; gradual smooth boundary.

2C—52 to 60 inches; dark yellowish brown (10YR 4/4) stratified loam and sandy loam; common fine faint grayish brown (10YR 5/2), brown (7.5YR 4/4), and strong brown (7.5YR 4/6) mottles; massive; medium acid.

The solum ranges from 43 to 68 inches in thickness. The A horizon has hue of 10YR, value of 3 or 4, and chroma of 2 or 3. The E horizon has hue of 10YR, value of 4 or 5, and chroma of 2 or 3. The control section has a clay content of 18 to 30 percent. The Bt horizon has hue of 10YR, value of 4 or 5, and chroma of 3 or 4. It is slightly acid to strongly acid. In some pedons a few gray mottles are as shallow as 45 inches. The part of the 2C horizon below a depth of 60 inches is stratified sand, fine sand, loamy sand, or loamy fine sand in which the content of pebbles is less than 5 percent.

Billett series

The Billett series consists of well drained soils on valley side slopes in the uplands. These soils typically formed in sandy and loamy eolian deposits. The native vegetation was mixed prairie grasses and deciduous trees. Permeability is moderately rapid in the upper part of the profile and rapid in the lower part. Slopes range from 5 to 14 percent.

These soils are taxadjuncts to the Billett series because they do not have an argillic horizon.

Typical pedon of Billett sandy loam, in an area of Ladoga-Billett complex, 5 to 9 percent slopes, moderately eroded, in a meadow; 1,450 feet west and 520 feet south of the center of sec. 12, T. 77 N., R. 9 W.

Ap—0 to 8 inches; very dark grayish brown (10YR 3/2) and dark brown (10YR 3/3) sandy loam, dark grayish brown (10YR 4/2) dry; mixed with some streaks and pockets of yellowish brown (10YR 5/6) subsoil material; weak fine granular structure; medium acid; abrupt smooth boundary.

BE—8 to 12 inches; brown (10YR 4/3) and yellowish brown (10YR 5/6) sandy loam; dark brown (10YR 3/3) coatings on faces of peds; weak fine subangular blocky structure; friable; medium acid; gradual smooth boundary.

Bt1—12 to 20 inches; yellowish brown (10YR 5/6) sandy loam; weak coarse subangular blocky structure; friable; thin nearly continuous brown (10YR 4/3) and dark brown (10YR 3/3) clay bridges between sand grains; dark brown (10YR 3/3) krotovinas; common fine roots; medium acid; gradual smooth boundary.

Bt2—20 to 28 inches; yellowish brown (10YR 5/6) sandy loam; weak coarse subangular blocky structure; friable; thin discontinuous brown (10YR 4/3) clay bridges between sand grains; common fine roots; medium acid; gradual smooth boundary.

BC—28 to 40 inches; yellowish brown (10YR 5/6) sandy loam; weak coarse subangular blocky structure; friable; very thin discontinuous dark yellowish brown (10YR 4/4) clay bridges between sand grains; few fine roots; slightly acid; gradual smooth boundary.

E&Bt—40 to 53 inches; brownish yellow (10YR 6/6) sand; single grained; very friable; strong brown (7.5YR 5/6) loamy sand lamallae, 0.5 inch thick, at depths of 41, 45, and 51 inches; slightly acid; gradual smooth boundary.

C—53 to 60 inches; brownish yellow (10YR 6/6) loamy sand; single grained; loose; slightly acid.

The solum ranges from 30 to more than 60 inches in thickness. It is slightly acid to strongly acid. The Ap or A horizon has hue of 10YR, value of 2 or 3, and chroma of 1 to 3. It is sandy loam or fine sandy loam. The Bt horizon has hue of 10YR or 7.5YR and value and chroma of 4 to 6. It typically is sandy loam, but some pedons have thin subhorizons of sandy clay loam. The C horizon is loamy sand or sand.

Bremer Series

The Bremer series consists of poorly drained, moderately slowly permeable soils on stream terraces or on the high parts of bottom land. These soils formed in silty alluvium. The native vegetation was swamp grasses, sedges, and prairie grasses that can tolerate wetness. Slopes range from 0 to 2 percent.

Typical pedon of Bremer silty clay loam, 0 to 2 percent slopes, in a cultivated field; 1,500 feet south and 400 feet west of the center of sec. 12, T. 77 N., R. 8 W.

Ap—0 to 10 inches; black (10YR 2/1) silty clay loam (31 percent clay), dark gray (10YR 4/1) dry; weak medium granular structure; friable; slightly acid; abrupt smooth boundary.

A—10 to 21 inches; black (N 2/0) silty clay loam (32 percent clay), very dark gray (10YR 3/1) dry; few fine faint grayish brown (2.5Y 5/2) mottles in the lower part; weak fine subangular blocky structure; friable; slightly acid; gradual smooth boundary.

Btg1—21 to 30 inches; grayish brown (2.5Y 5/2) silty clay (42 percent clay); few fine distinct light olive brown (2.5Y 5/4) mottles; moderate fine angular blocky structure; firm; thin nearly continuous dark gray (10YR 4/1) clay films on faces of peds; slightly acid; gradual smooth boundary.

Btg2—30 to 41 inches; grayish brown (2.5Y 5/2) silty clay (40 percent clay); few fine prominent brown (7.5YR 4/4) mottles; weak medium prismatic structure parting to moderate medium angular blocky; firm; thin nearly continuous dark gray (10YR 4/1) clay films on faces of peds and worm casts;

few dark concretions (iron and manganese oxides); slightly acid; gradual smooth boundary.

BCg—41 to 57 inches; grayish brown (2.5Y 5/2) and light brownish gray (2.5Y 6/2) silty clay loam (36 percent clay); common fine distinct yellowish brown (10YR 5/6 and 5/8) mottles; moderate medium prismatic structure; firm; very thin nearly continuous dark gray (10YR 4/1) clay films on faces of peds; few very dark gray (10YR 3/1) coatings in root channels; slightly acid; gradual smooth boundary.

Cg—57 to 60 inches; light brownish gray (2.5Y 6/2) silty clay loam (32 percent clay); common fine distinct yellowish brown (10YR 5/6 and 5/8) mottles; massive; firm; few very dark gray (10YR 3/1) coatings in root channels; slightly acid.

The solum ranges from 40 to 60 inches in thickness. It is slightly acid or medium acid.

The A horizon is 14 to 24 inches thick. It has a clay content of 25 to 32 percent. It is black (10YR 2/1 or N 2/0) or very dark gray (N 3/0). The B horizon has hue of 10YR, 2.5Y, or 5Y, value of 4 to 6, and chroma of 1 or 2. The clay content in the upper 20 inches of the argillic horizon is 36 to 42 percent.

Chelsea Series

The Chelsea series consists of excessively drained, rapidly permeable soils on upland side slopes. These soils formed in eolian sand. The native vegetation was deciduous trees. Slopes range from 5 to 25 percent.

Typical pedon of Chelsea loamy fine sand, in a cultivated area of Clinton-Lamont-Chelsea complex, 5 to 9 percent slopes, moderately eroded; 2,180 feet north and 100 feet west of the southeast corner of sec. 21, T. 77 N., R. 6 W.

Ap—0 to 7 inches; brown (10YR 4/3) loamy fine sand, pale brown (10YR 6/3) dry; weak fine granular structure; very friable; slightly acid; abrupt smooth boundary.

E1—7 to 18 inches; brown (10YR 4/3) and yellowish brown (10YR 5/4) fine sand, very pale brown (10YR 7/3) dry; weak thick platy structure; loose; strongly acid; gradual smooth boundary.

E2—18 to 32 inches; light yellowish brown (10YR 6/4) fine sand, very pale brown (10YR 7/4) dry; single grained; loose; strongly acid; gradual smooth boundary.

E&Bt—32 to 60 inches; brownish yellow (10YR 6/6) and light yellowish brown (10YR 6/4) fine sand; single grained; loose; dark brown (7.5YR 4/4) loamy sand lamallae, 0.5 to 1.0 inch thick, at depths of 36, 40, 46, and 50 inches; strongly acid.

The solum ranges from 4 to many feet in thickness. It is slightly acid to strongly acid.

The Ap horizon has hue of 10YR, value of 4, and chroma of 2 or 3. It is loamy fine sand or fine sand. The upper part of the E horizon has hue of 10YR, value of 4, and chroma of 2 to 4. The lower part has hue of 10YR and value and chroma of 4 to 6. The E horizon is 18 to 40 inches thick. The E&Bt horizon is sand or fine sand. It is brownish yellow (10YR 6/6) or light yellowish brown (10YR 6/4). The B part of this horizon occurs as lamellae 0.25 inch to 2.0 inches thick. It has hue of 7.5YR or 10YR and value and chroma of 3 or 4. It is sandy loam or loamy sand. The depth to the lamellae commonly is 36 inches but ranges from 27 to 46 inches. The lamellae total less than 6 inches thick in the part of the pedon within a depth of 60 inches.

Clarinda Series

The Clarinda series consists of poorly drained, very slowly permeable soils on convex upland side slopes and in coves at the head of drainageways. These soils formed in a thin mantle of loess and a gray, clayey paleosol that formed in glacial till. The native vegetation was mixed prairie grasses. Slopes range from 5 to 14 percent.

Typical pedon of Clarinda silty clay loam, 5 to 9 percent slopes, moderately eroded, in a cultivated field; 1,400 feet east and 940 feet south of the northwest corner of sec. 14, T. 75 N., R. 6 W.

Ap—0 to 11 inches; very dark gray (10YR 3/1) silty clay loam, dark gray (10YR 4/1) dry; mixed with some streaks and pockets of gray (10YR 5/1) subsoil material; black (10YR 2/1) coatings on faces of peds; common fine distinct strong brown (7.5YR 4/6) mottles; weak fine subangular blocky structure parting to moderate fine granular; friable; neutral; abrupt smooth boundary.

2Btg1—11 to 28 inches; gray (10YR 5/1) silty clay; few very dark gray (10YR 3/1) coatings on faces of peds; few fine prominent reddish brown (5YR 4/4) and few fine distinct strong brown (7.5YR 5/6) mottles; moderate very fine subangular blocky structure; very firm; thick continuous dark gray (10YR 4/1) clay films on faces of peds; few white sand grains; slightly acid; gradual smooth boundary.

2Btg2—28 to 39 inches; gray (10YR 5/1) silty clay; few fine distinct light olive brown (2.5Y 5/4) mottles; weak medium subangular blocky structure; very firm; thick continuous dark gray (10YR 4/1) clay films on faces of peds; few sand grains; slightly acid; gradual smooth boundary.

2Btg3—39 to 60 inches; gray (10YR 5/1) silty clay; few fine distinct light olive brown (2.5Y 5/4) mottles in bands; weak medium subangular blocky structure; very firm; thin continuous dark gray (10YR 4/1) clay films on faces of peds; slightly acid.

The solum commonly is more than 60 inches thick. It ranges from neutral to strongly acid.

The A horizon is very dark gray (10YR 3/1) or black (10YR 2/1). The 2Btg horizon has hue of 10YR, 2.5Y, or 5Y, value of 4 or 5, and chroma of 1. It is silty clay or clay that has a maximum clay content of 45 to 58 percent.

Clarinda silty clay loam, 5 to 9 percent slopes, severely eroded, and Clarinda silty clay loam, 9 to 14 percent slopes, severely eroded, are taxadjuncts to the Clarinda series because they do not have a mollic epipedon.

Clinton Series

The Clinton series consists of moderately well drained, moderately slowly permeable soils on uplands and high stream benches. These soils formed in loess. The native vegetation was deciduous trees. Slopes range from 2 to 14 percent.

Typical pedon of Clinton silt loam, 5 to 9 percent slopes, moderately eroded, in a cultivated field; 1,050 feet east and 1,620 feet south of the northwest corner of sec. 3, T. 76 N., R. 6 W.

Ap—0 to 8 inches; dark grayish brown (10YR 4/2) and brown (10YR 4/3) silt loam (24 percent clay), light brownish gray (10YR 6/2) dry; mixed with some streaks and pockets of yellowish brown (10YR 5/4) silty clay loam subsoil material; very weak fine subangular blocky structure parting to weak fine granular; friable; few small dark accumulations (iron and manganese oxides); slightly acid; abrupt smooth boundary.

Bt1—8 to 16 inches; yellowish brown (10YR 5/4) silty clay loam (33 percent clay); moderate fine subangular blocky structure; friable; thin discontinuous brown (10YR 4/3) clay films on faces of peds; common light gray (10YR 7/1) dry silt coatings on faces of peds; few small dark accumulations (iron and manganese oxides); medium acid; gradual smooth boundary.

Bt2—16 to 26 inches; yellowish brown (10YR 5/4) silty clay loam (37 percent clay); strong medium angular blocky structure parting to moderate fine subangular blocky; firm; thin discontinuous dark yellowish brown (10YR 4/4) clay films on faces of peds; many light gray (10YR 7/1) dry silt coatings on faces of peds; few fine dark accumulations (iron and manganese oxides); strongly acid; gradual smooth boundary.

Bt3—26 to 37 inches; yellowish brown (10YR 5/4) silty clay loam (37 percent clay); few fine faint grayish brown (2.5Y 5/2) mottles below a depth of 30 inches and few fine distinct strong brown (7.5YR 5/8) mottles; moderate fine angular blocky structure; firm; thin continuous dark yellowish brown (10YR 4/4) clay films on vertical faces of peds; many light gray (10YR 7/1) dry silt coatings on faces of peds; few fine dark accumulations (iron and manganese oxides); strongly acid; gradual smooth boundary.

Bt4—37 to 48 inches; yellowish brown (10YR 5/4) silty clay loam (33 percent clay); few fine distinct grayish brown (2.5Y 5/2) and strong brown (7.5YR 5/8) mottles; moderate medium prismatic structure; friable; nearly continuous dark yellowish brown (10YR 4/4) clay films on vertical faces of peds; brown (10YR 4/3) clay flows in root channels; few light gray (10YR 7/1) dry silt coatings on faces of peds; few fine dark accumulations (iron and manganese oxides); medium acid; gradual smooth boundary.

BC—48 to 60 inches; yellowish brown (10YR 5/4) silty clay loam (28 percent clay); weak medium prismatic structure; friable; thin discontinuous brown (10YR 4/3) clay films on faces of peds; very few light gray (10YR 7/1) silt coatings on faces of peds; few fine dark accumulations (iron and manganese oxides); medium acid.

The solum ranges from 42 to more than 60 inches in thickness. It is slightly acid to strongly acid.

The moderately eroded Clinton soils have an Ap horizon that is dark grayish brown (10YR 4/2) or brown (10YR 4/3). The uneroded Clinton soils have an A horizon that is very dark grayish brown (10YR 3/2) or very dark gray (10YR 3/1) silt loam as much as 5 inches thick. The Bt horizon has hue of 10YR, value of 4 or 5, and chroma of 3 or 4. The clay content ranges from 32 to 42 percent in this horizon. It is 35 to 38 percent in the upper 20 inches of the argillic horizon. The BC horizon is brown (10YR 4/3) or yellowish brown (10YR 5/6).

Colo Series

The Colo series consists of poorly drained, moderately permeable soils on flood plains, on alluvial fans, and in upland drainageways. These soils formed in silty alluvium. The native vegetation was swamp grasses, sedges, and prairie grasses that can tolerate wetness. Slopes range from 0 to 5 percent.

Typical pedon of Colo silty clay loam, in a cultivated area of Colo-Zook silty clay loams, 0 to 3 percent slopes; 1,293 feet east and 1,245 feet south of the center of sec. 17, T. 76 N., R. 8 W.

Ap—0 to 7 inches; black (N 2/0) silty clay loam (30 percent clay), very dark gray (10YR 3/1) dry; weak fine subangular blocky structure parting to weak fine granular; friable; neutral; abrupt smooth boundary.

A1—7 to 20 inches; black (N 2/0) silty clay loam (30 percent clay), very dark gray (N 3/0) dry; weak fine subangular blocky structure parting to moderate fine granular; friable; neutral; gradual smooth boundary.

A2—20 to 37 inches; very dark gray (N 3/0) silty clay loam (35 percent clay), dark gray (N 4/0) dry;

moderate very fine and fine subangular blocky and angular blocky structure; firm; neutral; gradual smooth boundary.

AC—37 to 47 inches; very dark gray (N 3/0) silty clay loam (35 percent clay), dark gray (N 4/0) dry; weak medium prismatic structure parting to weak fine subangular blocky; firm; neutral; gradual smooth boundary.

Cg—47 to 60 inches; dark gray (N 4/0) silty clay loam; few fine distinct brown (7.5YR 4/4) and few fine faint dark gray (10YR 4/1) mottles; moderate medium prismatic structure; firm; neutral.

The solum ranges from 36 to 60 inches in thickness. It is neutral to medium acid. The mollic epipedon is 36 or more inches thick.

Some pedons have overwash of stratified dark gray (10YR 4/1), very dark grayish brown (10YR 3/2), and grayish brown (10YR 5/2) silt loam 6 to 18 inches thick. The overwash is slightly acid or neutral. The A horizon has hue of N, 5Y, or 10YR, value of 2 or 3, and chroma of 0 or 1. Some pedons have a clay content of 36 to 40 percent in some horizons. In these pedons the 10- to 40-inch control section has a clay content of 27 to 35 percent. Value of 2 to 4 and chroma of 0 or 1 extend to a depth of 36 inches or more.

Coppock Series

The Coppock series consists of poorly drained, moderately permeable soils on foot slopes, alluvial fans, and first bottoms along the major streams. These soils formed in silty alluvium. The native vegetation was deciduous trees and mixed prairie grasses. Slopes range from 0 to 5 percent.

Typical pedon of Coppock silt loam, 0 to 2 percent slopes, in a pastured area; 1,360 feet west and 520 feet north of the southeast corner of sec. 17, T. 77 N., R. 8 W.

Ap—0 to 7 inches; very dark gray (10YR 3/1) silt loam (25 percent clay), very dark grayish brown (10YR 3/2) kneaded; weak fine granular structure; friable; neutral; abrupt smooth boundary.

E1—7 to 11 inches; dark grayish brown (10YR 4/2) silt loam (21 percent clay); few very dark gray (10YR 3/1) coatings on faces of peds; weak thin platy structure; friable; light gray (10YR 7/2) dry silt coatings on faces of peds; neutral; clear smooth boundary.

E2—11 to 18 inches; dark grayish brown (10YR 4/2) silt loam (22 percent clay); common fine distinct dark reddish brown (5YR 3/4) mottles; moderate medium platy structure parting to weak fine subangular and angular blocky; friable; light gray (10YR 7/2) dry silt coatings on faces of peds; slightly acid; clear wavy boundary.

E/B—18 to 26 inches; dark grayish brown (10YR 4/2) and grayish brown (10YR 5/2) silt loam (Bt part, 26 percent clay); common fine faint yellowish brown (10YR 5/4) and common fine distinct strong brown (7.5YR 5/6) mottles; moderate medium subangular blocky structure parting to weak thin platy; friable; light gray (10YR 7/2) dry silt coatings (E) on faces of peds; medium acid; gradual smooth boundary.

Btg1—26 to 33 inches; grayish brown (10YR 5/2) silty clay loam (35 percent clay); dark gray (10YR 4/1) coatings on faces of peds; common fine faint yellowish brown (10YR 5/6) and common fine distinct strong brown (7.5YR 5/6) mottles; weak medium subangular blocky structure; friable; thin nearly continuous very dark gray (10YR 3/1) clay films on faces of peds; light gray (10YR 7/2) dry silt coatings on faces of peds; medium acid; gradual smooth boundary.

Btg2—33 to 39 inches; grayish brown (10YR 5/2) and light brownish gray (10YR 6/2) silty clay loam (35 percent clay); common fine faint yellowish brown (10YR 5/6) and common fine distinct strong brown (7.5YR 5/6) mottles; moderate medium prismatic structure parting to weak medium subangular blocky; friable; thin nearly continuous very dark gray (10YR 3/1) clay films on faces of peds; light gray (10YR 7/2) dry silt coatings on faces of peds; very dark gray (10YR 3/1) clay flows in root channels; medium acid; gradual smooth boundary.

Btg3—39 to 50 inches; grayish brown (10YR 5/2) silty clay loam (34 percent clay); few medium prominent reddish brown (5YR 4/4) and many medium distinct strong brown (7.5YR 5/6) mottles; moderate medium prismatic structure; firm; light gray (10YR 7/2) dry silt coatings on faces of peds; very dark gray (10YR 3/1) clay flows in root channels; medium acid; gradual smooth boundary.

BCg—50 to 60 inches; grayish brown (10YR 5/2) silty clay loam; few medium prominent reddish brown (5YR 4/4) and few medium distinct strong brown (7.5YR 5/6) mottles; moderate medium prismatic structure; firm; few very dark gray (10YR 3/1) clay flows in root channels; medium acid.

The solum ranges from 40 to 70 inches in thickness. The A horizon is very dark gray (10YR 3/1) or very dark grayish brown (10YR 3/2). The E horizon has hue of 10YR, value of 4 to 6, and chroma of 1 or 2. The thickness of this horizon combined with that of the E/B horizon is 14 to 24 inches. The Btg horizon has hue of 10YR or 2.5Y, value of 5 or 6, and chroma of 1 or 2. It is medium acid to very strongly acid. The control section has a clay content of 30 to 35 percent.

Dickinson Series

The Dickinson series consists of somewhat excessively drained soils on stream terraces. These soils formed in loamy and sandy alluvial sediments. The native vegetation was mixed prairie grasses. Permeability is moderately rapid in the upper part of the profile and rapid in the lower part. Slopes range from 0 to 2 percent.

Typical pedon of Dickinson sandy loam, 0 to 2 percent slopes, in a cultivated field; 1,000 feet west and 900 feet north of the southeast corner of sec. 3, T. 77 N., R. 6 W.

Ap—0 to 8 inches; black (10YR 2/1) and very dark brown (10YR 2/2) sandy loam, dark grayish brown (10YR 4/2) dry; moderate fine granular structure; friable; slightly acid; abrupt smooth boundary.

A—8 to 12 inches; black (10YR 2/1) and very dark brown (10YR 2/2) sandy loam, dark grayish brown (10YR 4/2) dry; mixed with a few streaks and pockets of dark brown (10YR 3/3) subsoil material; weak fine granular structure; friable; slightly acid; clear smooth boundary.

BA—12 to 17 inches; brown (10YR 4/3) sandy loam; dark brown (10YR 3/3) and very dark brown (10YR 2/2) coatings on faces of peds; weak fine subangular blocky structure; friable; medium acid; gradual smooth boundary.

Bw1—17 to 25 inches; brown (10YR 4/3) sandy loam; dark brown (10YR 3/3) coatings on faces of peds; weak medium subangular blocky structure parting to weak fine subangular blocky; friable; slightly acid; gradual smooth boundary.

Bw2—25 to 31 inches; yellowish brown (10YR 5/4) sandy loam; brown (10YR 4/3) coatings on faces of peds; weak medium subangular blocky structure; very friable; slightly acid; gradual smooth boundary.

BC—31 to 38 inches; yellowish brown (10YR 5/4) sandy loam; weak coarse subangular blocky structure; very friable; medium acid; gradual smooth boundary.

2C1—38 to 50 inches; yellowish brown (10YR 5/4) sand; single grained; loose; lense of fine sand, 3 inches thick, at a depth of 46 inches; medium acid; gradual smooth boundary.

2C2—50 to 60 inches; yellowish brown (10YR 5/4) sand; single grained; loose; medium acid.

The solum ranges from 24 to 50 inches in thickness. The mollic epipedon is 12 to 24 inches thick.

The A horizon has hue of 10YR, value of 2 or 3, and chroma of 1 or 2. It is fine sandy loam, sandy loam, or loam. The upper part of the Bw horizon has hue of 10YR, value of 3 or 4, and chroma of 2 or 3. The lower part has hue of 10YR, value of 4 or 5, and chroma of 4 to 6. The Bw horizon is sandy loam or fine sandy loam and is slightly to strongly acid. The 2C horizon has hue of 10YR, value of 4 or 5, and chroma of 3 to 6. It is loamy fine sand, loamy sand, fine sand, or sand.

Douds Series

The Douds series consists of moderately well drained, moderately permeable soils on side slopes in the uplands. These soils formed in alluvial and colluvial sediments derived from glacial till. The native vegetation was deciduous trees. Slopes range from 9 to 18 percent.

Typical pedon of Douds loam, 9 to 14 percent slopes, moderately eroded, in a cultivated field; 1,300 feet south and 760 feet east of the northwest corner of sec. 15, T. 75 N., R. 9 W.

Ap—0 to 5 inches; dark grayish brown (10YR 4/2) loam, light brownish gray (10YR 6/2) dry; mixed with streaks and pockets of yellowish brown (10YR 5/4) subsoil material; weak fine subangular blocky structure; friable; slightly acid; abrupt smooth boundary.

BE—5 to 10 inches; yellowish brown (10YR 5/4) and brown (10YR 4/3) loam; weak medium platy structure parting to weak fine subangular blocky; friable; thin discontinuous light gray (10YR 7/2) dry silt coatings on faces of peds; slightly acid; clear smooth boundary.

Bt1—10 to 15 inches; yellowish brown (10YR 5/4) clay loam; weak medium and fine subangular blocky structure; friable; thin nearly continuous dark yellowish brown (10YR 4/4) clay films on faces of peds; thin discontinuous light gray (10YR 7/2) dry silt coatings on faces of peds; dark yellowish brown (10YR 4/4) clay flows in root channels; medium acid; gradual smooth boundary.

Bt2—15 to 23 inches; strong brown (7.5YR 5/6) and yellowish brown (10YR 5/6) clay loam; moderate medium and fine subangular blocky structure; friable; thin nearly continuous brown (7.5YR 4/4) clay films on faces of peds; thin discontinuous light gray (10YR 7/2) dry silt coatings on faces of peds; few small dark concretions (iron and manganese oxides); noticeable coarse sand grains; few small pebbles; medium acid; gradual smooth boundary.

Bt3—23 to 29 inches; strong brown (7.5YR 5/6) clay loam; moderate medium and fine subangular blocky structure; firm; thin discontinuous brown (7.5YR 4/4) clay films on faces of peds; thin nearly continuous light gray (10YR 7/2) dry silt coatings on faces of peds; few small dark concretions (iron and manganese oxides); few very pale brown (10YR 7/3) dry fine sand grains; few small pebbles; medium acid; gradual smooth boundary.

Bt4—29 to 38 inches; strong brown (7.5YR 5/6 and 5/8) clay loam; weak medium prismatic structure parting to weak medium and fine subangular and angular blocky; firm; thin nearly continuous brown (7.5YR 4/4) clay films on faces of peds; few small dark concretions (iron and manganese oxides); few very pale brown (10YR 7/3) dry fine sand grains; few

small pebbles; strongly acid; gradual smooth boundary.

Bt5—38 to 46 inches; strong brown (7.5YR 5/6) stratified clay loam and sandy clay loam; common fine distinct light yellowish brown (2.5Y 6/4) and reddish brown (5YR 4/4) mottles; weak medium prismatic structure parting to moderate medium subangular blocky; friable; thin discontinuous brown (7.5YR 4/4) clay films on faces of peds; few small dark concretions (iron and manganese oxides); few very pale brown (10YR 7/3) dry fine sand grains; few small pebbles; strongly acid; gradual smooth boundary.

BC—46 to 60 inches; strong brown (7.5YR 5/6 and 5/8) stratified sandy loam, loam, and sandy clay loam; common fine distinct light brownish gray (2.5Y 6/2) and reddish brown (5YR 4/4) mottles; massive with some horizontal cleavage caused by stratification; friable; yellowish red (5YR 4/6) iron bands, 2 inches thick, at depths of 46 and 58 inches; strongly acid.

The solum ranges from 36 to 72 inches in thickness. It is slightly acid to very strongly acid.

The Ap horizon has hue of 10YR, value of 4 or 5, and chroma of 2 or 3. Pedons in uncultivated areas have A and E horizons. The A horizon has hue of 10YR, value of 3, and chroma of 1 or 2. It is less than 6 inches thick. The Bt horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 4 to 8. It is sandy clay loam, loam, or clay loam. Strata of loam, sandy loam, or loamy sand are common in the BC and C horizons.

Elrin Series

The Elrin series consists of somewhat poorly drained soils on stream terraces. These soils formed in loamy and sandy alluvial sediments. The native vegetation was mixed prairie grasses. Permeability is moderate in the upper part of the profile and rapid in the lower part. Slopes range from 0 to 2 percent.

Typical pedon of Elrin loam, 0 to 2 percent slopes, in a cultivated field; 1,440 feet west and 530 feet north of the southeast corner of sec. 15, T. 77 N., R. 6 W.

Ap—0 to 7 inches; black (10YR 2/1) and very dark brown (10YR 2/2) loam, dark grayish brown (10YR 4/2) dry; weak fine granular structure; friable; slightly acid; abrupt smooth boundary.

A—7 to 12 inches; very dark brown (10YR 2/2) and black (10YR 2/1) loam, dark grayish brown (10YR 4/2) dry; weak fine granular structure; friable; medium acid; clear smooth boundary.

AB—12 to 15 inches; very dark grayish brown (10YR 3/2) and dark grayish brown (10YR 4/2) loam, grayish brown (10YR 5/2) dry; few fine faint brown (10YR 4/3) mottles; weak medium subangular blocky structure; friable; medium acid; clear smooth boundary.

Bw1—15 to 20 inches; dark grayish brown (10YR 4/2) loam; common fine faint brown (10YR 4/3) and few fine distinct dark brown (7.5YR 3/4) mottles; weak medium subangular blocky structure; friable; medium acid; gradual smooth boundary.

Bw2—20 to 25 inches; grayish brown (10YR 5/2) sandy loam; common fine distinct strong brown (7.5YR 5/6 and 5/8) and few fine distinct dark brown (7.5YR 3/4) mottles; weak medium subangular blocky structure; friable; few small black (10YR 2/1) concretions (iron and manganese oxides); medium acid; gradual smooth boundary.

Bw3—25 to 32 inches; brown (10YR 5/3) and grayish brown (10YR 5/2) sandy loam; common fine distinct strong brown (7.5YR 5/6 and 5/8) and few fine distinct dark reddish brown (5YR 3/3) mottles; weak coarse subangular blocky structure; friable; few small black (10YR 2/1) concretions (iron and manganese oxides); medium acid; gradual smooth boundary.

Bw4—32 to 39 inches; yellowish brown (10YR 5/4) loamy sand; common fine faint grayish brown (10YR 5/2), common fine distinct dark brown (7.5YR 3/4), and few fine distinct strong brown (7.5YR 5/6 and 5/8) mottles; weak medium prismatic structure; very friable; medium acid; gradual smooth boundary.

BC—39 to 54 inches; brown (10YR 5/3) sand and coarse sand; dark brown (7.5YR 3/4) bands at depths of 42 and 49 inches; weak coarse prismatic structure; very friable; about 2 to 3 percent gravel; slightly acid; gradual smooth boundary.

C—54 to 60 inches; brown (10YR 5/3) sand; single grained; loose; about 5 percent gravel; slightly acid.

The solum is more than 48 inches thick. It ranges from slightly acid to strongly acid.

The Ap or A horizon is black (10YR 2/1), very dark brown (10YR 2/2), or very dark grayish brown (10YR 3/2) loam or silt loam that has a high content of sand. The Bw horizon has hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 2 to 4. If the chroma is 3 or 4, this horizon has mottles with chroma of 2. It is loam in the upper part and sandy loam, fine sandy loam, or loamy sand in the lower part. The 10- to 40-inch control section has a clay content of 14 to 18 percent. The BC and C horizons have hue of 10YR or 2.5Y, value of 2 to 5, and chroma of 2 to 4.

Ely Series

The Ely series consists of somewhat poorly drained, moderately permeable soils on foot slopes. These soils formed in silty alluvium. The native vegetation was mixed prairie grasses. Slopes range from 2 to 5 percent.

Typical pedon of Ely silty clay loam, 2 to 5 percent slopes, in a hayfield; 640 feet east and 380 feet south of the center of sec. 6, T. 77 N., R. 7 W.

Ap—0 to 8 inches; black (10YR 2/1) and very dark brown (10YR 2/2) silty clay loam, very dark grayish brown (10YR 3/2) dry; weak fine subangular blocky structure parting to moderate fine granular; friable; slightly acid; abrupt smooth boundary.

A1—8 to 17 inches; black (10YR 2/1) and very dark brown (10YR 2/2) silty clay loam, very dark grayish brown (10YR 3/2) dry; moderate medium granular structure; friable; slightly acid; gradual smooth boundary.

A2—17 to 26 inches; black (10YR 2/1), very dark brown (10YR 2/2), and dark brown (10YR 3/3) silty clay loam, very dark grayish brown (10YR 3/2) dry; weak coarse subangular blocky structure parting to moderate medium granular; friable; slightly acid; gradual smooth boundary.

BA—26 to 37 inches; very dark grayish brown (10YR 3/2), dark grayish brown (10YR 4/2), and yellowish brown (10YR 5/4) silty clay loam; weak medium prismatic structure parting to weak medium and fine subangular blocky; friable; slightly acid; gradual smooth boundary.

Bw—37 to 50 inches; yellowish brown (10YR 5/4), brown (10YR 4/3), and grayish brown (10YR 5/2) silty clay loam; very dark grayish brown (10YR 3/2) coatings on faces of peds; few fine distinct strong brown (7.5YR 5/6) mottles; friable; very dark gray (10YR 3/1) clay flows in root channels; common small dark accumulations (iron and manganese oxides); neutral; gradual smooth boundary.

BC—50 to 60 inches; yellowish brown (10YR 5/4) and grayish brown (2.5Y 5/2) silty clay loam; common fine distinct strong brown (7.5YR 5/6) mottles; weak medium prismatic structure; friable; few very dark gray (10YR 3/1) clay flows in root channels; common small dark accumulations (iron and manganese oxides); neutral; gradual smooth boundary.

The solum ranges from 40 to 70 inches in thickness. It is neutral or slightly acid. Matrix colors with value of 3 or darker extend to a depth of 24 to 36 inches.

The A horizon has hue of 10YR, value of 2 or 3, and chroma of 1 or 2. The Bw horizon has hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 2 to 4. The B horizon has a clay content of 28 to 35 percent. The C horizon typically is silty clay loam but in some pedons is loam, clay loam, or silt loam.

Fayette Series

The Fayette series consists of well drained, moderately permeable soils on upland side slopes. These soils formed in loess. The native vegetation was deciduous trees. Slopes range from 14 to 40 percent.

Typical pedon of Fayette silt loam, 18 to 25 percent slopes, in a permanent pasture; 800 feet west and 250 feet south of the northeast corner of sec. 33, T. 77 N., R. 6 W.

Ap—0 to 6 inches; dark grayish brown (10YR 4/2) silt loam (21 percent clay), light brownish gray (10YR 6/2) dry; few dark brown (10YR 3/3) organic coatings; weak thin platy structure parting to weak fine granular; friable; medium acid; abrupt smooth boundary.

E—6 to 10 inches; brown (10YR 4/3) and yellowish brown (10YR 5/4) silt loam (20 percent clay), pale brown (10YR 6/3) dry; moderate medium platy structure parting to weak fine subangular blocky; friable; medium acid; clear smooth boundary.

BE—10 to 15 inches; yellowish brown (10YR 5/4) silt loam (25 percent clay); brown (10YR 4/3) coatings on faces of peds; weak fine subangular blocky structure; friable; thin discontinuous light gray (10YR 7/2) dry silt coatings on faces of peds; medium acid; gradual smooth boundary.

Bt1—15 to 23 inches; yellowish brown (10YR 5/4) silty clay loam (28 percent clay); moderate fine angular and subangular blocky structure; friable; thin nearly continuous brown (10YR 4/3) clay films on faces of peds; thin discontinuous light gray (10YR 7/2) dry silt coatings on faces of peds; strongly acid; gradual smooth boundary.

Bt2—23 to 33 inches; yellowish brown (10YR 5/4) silty clay loam (32 percent clay); few fine distinct strong brown (7.5YR 5/6) mottles; moderate medium subangular blocky structure; friable; thin nearly continuous brown (10YR 4/3) clay films on faces of peds; thin discontinuous light gray (10YR 7/2) dry silt coatings on faces of peds; few small dark accumulations (iron and manganese oxides); strongly acid; gradual smooth boundary.

Bt3—33 to 41 inches; yellowish brown (10YR 5/4) silty clay loam (33 percent clay); few fine distinct strong brown (7.5YR 5/6) and few fine faint grayish brown (10YR 5/2) mottles; moderate fine prismatic structure parting to weak medium subangular blocky; friable; thin nearly discontinuous brown (10YR 4/3) clay films on faces of peds; thin discontinuous light gray (10YR 7/2) dry silt coatings on faces of peds; few small dark accumulations (iron and manganese oxides); medium acid; gradual smooth boundary.

BC—41 to 51 inches; yellowish brown (10YR 5/4) and dark yellowish brown (10YR 4/4) silty clay loam (32 percent clay); few fine distinct strong brown (7.5YR 5/6) and few fine faint light brownish gray (10YR 6/2) mottles; moderate medium prismatic structure; friable; thick nearly continuous light gray (10YR 7/2) dry silt coatings on faces of peds; common small dark accumulations (iron and manganese oxides); medium acid; gradual smooth boundary.

C—51 to 60 inches; yellowish brown (10YR 5/4), dark yellowish brown (10YR 4/4), and grayish brown

(10YR 5/2) silt loam (26 percent clay); many fine distinct strong brown (7.5YR 5/6) mottles; massive with some distinct vertical cleavage; friable; thick nearly continuous light gray (10YR 7/2) dry silt coatings along vertical cleavage planes; common small dark accumulations (iron and manganese oxides); slightly acid.

The solum ranges from 36 to 60 inches in thickness. It is slightly acid to very strongly acid.

The Ap horizon has hue of 10YR, value of 4, and chroma of 2 or 3. The E horizon has hue of 10YR, value of 4 or 5, and chroma of 1 to 4. The Bt horizon has hue of 10YR, value of 4 or 5, and chroma of 3 or 4. It is silty clay loam that has a clay content of 28 to 35 percent. Most pedons have mottles with hue of 10YR or 2.5Y, value of 5, and chroma of 2 below a depth of 30 inches.

Galland Series

The Galland series consists of somewhat poorly drained, slowly permeable soils on side slopes in the uplands. These soils formed in loamy and clayey alluvial and colluvial sediments derived from glacial till. The native vegetation was deciduous trees. Slopes range from 9 to 14 percent.

Typical pedon of Galland clay loam, in a cultivated area of Galland-Douds clay loams, 9 to 14 percent slopes, severely eroded; 1,440 feet east and 400 feet south of the northwest corner of sec. 24, T. 76 N., R. 6 W.

Ap1—0 to 2 inches; dark grayish brown (10YR 4/2) clay loam, pale brown (10YR 6/3) dry; mixed with streaks and pockets of yellowish brown (10YR 5/4) and brown (10YR 4/3) subsoil material; weak fine subangular blocky structure; firm; slightly acid; abrupt broken boundary.

Ap2—2 to 6 inches; yellowish brown (10YR 5/4) clay loam, light yellowish brown (10YR 6/4) dry; mixed with streaks and pockets of brown (7.5YR 5/4) and reddish brown (5YR 5/4) subsoil material; weak fine subangular blocky structure; firm; medium acid; abrupt smooth boundary.

Bt1—6 to 12 inches; reddish brown (5YR 5/4) and brown (7.5YR 5/4) clay loam; moderate medium subangular blocky structure; firm; common thin discontinuous reddish brown (5YR 4/3) clay films on faces of peds; medium acid; clear smooth boundary.

Bt2—12 to 18 inches; reddish brown (5YR 5/4) and strong brown (7.5YR 5/6) clay loam; few medium distinct grayish brown (10YR 5/2) mottles; moderate medium subangular blocky structure; firm; thin nearly continuous reddish brown (5YR 4/3) clay films on faces of peds; medium acid; gradual smooth boundary.

Bt3—18 to 24 inches; strong brown (7.5YR 5/6) and yellowish red (5YR 5/6) clay loam; common medium distinct grayish brown (10YR 5/2) mottles; moderate medium subangular blocky structure; firm; thin discontinuous reddish brown (5YR 4/4) clay films on faces of peds; thick dark brown (7.5YR 3/2) clay accumulation; medium acid; gradual smooth boundary.

Bt4—24 to 31 inches; strong brown (7.5YR 5/6) and brown (7.5YR 5/4) clay loam that has a few thin strata of sandy loam; few medium distinct grayish brown (10YR 5/2) mottles; weak medium subangular blocky structure; friable; thin discontinuous brown (7.5YR 4/4) clay films on faces of peds; strongly acid; gradual smooth boundary.

Bt5—31 to 39 inches; strong brown (7.5YR 5/6) and brown (7.5YR 5/4) stratified sandy loam and sandy clay loam; few fine distinct grayish brown (10YR 5/2) mottles; weak medium prismatic structure parting to weak coarse subangular blocky; friable; few thin discontinuous brown (7.5YR 4/4) clay films of vertical faces of peds; strongly acid; gradual smooth boundary.

BC—39 to 50 inches; strong brown (7.5YR 5/6) sandy loam that has a few thin strata of sandy clay loam; weak medium prismatic structure; friable; strongly acid; gradual smooth boundary.

C—50 to 60 inches; strong brown (7.5YR 5/6) sandy loam; few fine distinct reddish brown (5YR 4/3) mottles; massive; very friable; medium acid.

The solum ranges from 36 to 72 inches in thickness. It is slightly acid to strongly acid.

The Ap horizon has hue of 10YR, value of 4 or 5, and chroma of 2 to 4. Uneroded areas have an A horizon of loam. This horizon has hue of 10YR, value of 3, and chroma of 1 or 2. It is 3 to 6 inches thick. The Bt horizon has hue of 10YR, 7.5YR, or 5YR, value of 3 to 5, and chroma of 2 to 6. It has hue of 7.5YR or redder in the matrix or in the many distinct or prominent mottles. It has a clay content of 35 to 48 percent. The lower part of the solum varies in texture, and the substratum ranges from clay to sandy loam.

Gara Series

The Gara series consists of well drained, moderately slowly permeable soils on convex side slopes and nose slopes in the uplands. These soils formed in glacial till. The native vegetation was deciduous trees and mixed prairie grasses. Slopes range from 9 to 18 percent.

Typical pedon of Gara loam, 9 to 14 percent slopes, moderately eroded, in a grassed area; 1,960 feet north and 140 feet west of the southeast corner of sec. 14, T. 76 N., R. 7 W.

Ap—0 to 8 inches; very dark grayish brown (10YR 3/2) loam, brown (10YR 5/3) dry; mixed with streaks and pockets of brown (10YR 4/3) subsoil material; weak

fine granular structure; friable; medium acid; abrupt smooth boundary.

Bt1—8 to 12 inches; brown (10YR 4/3) loam; few very dark grayish brown (10YR 3/2) coatings on faces of peds; weak fine subangular blocky structure; friable; thin discontinuous clay films on faces of peds; medium acid; gradual smooth boundary.

Bt2—12 to 19 inches; yellowish brown (10YR 5/6) clay loam; few brown (10YR 4/3) coatings on faces of peds; moderate fine subangular blocky structure; firm; thin discontinuous clay films on faces of peds; few small pebbles; strongly acid; gradual smooth boundary.

Bt3—19 to 26 inches; yellowish brown (10YR 5/4 and 5/6) clay loam; moderate fine and medium subangular blocky structure; firm; thin discontinuous clay films on faces of peds; few small pebbles; strongly acid; gradual smooth boundary.

Bt4—26 to 35 inches; yellowish brown (10YR 5/4 and 5/6) clay loam; many fine distinct grayish brown (10YR 5/2) mottles; weak medium subangular blocky structure; firm; thin discontinuous clay films on faces of peds; few dark brown (10YR 3/3) concretions (iron and manganese oxides); few small pebbles; medium acid; gradual smooth boundary.

BC—35 to 51 inches; yellowish brown (10YR 5/4 and 5/6) clay loam; many medium distinct light gray (10YR 6/1) mottles; weak medium prismatic structure; firm; thin discontinuous clay films on faces of peds; few dark brown (10YR 3/3) concretions (iron and manganese oxides); few small pebbles; slightly acid; gradual smooth boundary.

C—51 to 60 inches; yellowish brown (10YR 5/4 and 5/6) clay loam; many medium distinct light gray (10YR 6/1) mottles; massive; firm; few soft accumulations (calcium carbonates); few pebbles; slight effervescence; mildly alkaline.

The thickness of the solum ranges from 36 to 70 inches. It generally corresponds to the depth to carbonates. Most pedons have a few pebbles and stones throughout.

The A or Ap horizon is very dark gray (10YR 3/1) or very dark grayish brown (10YR 3/2). Pedons in most plowed or eroded areas do not have an E horizon. The Bt horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 3 to 6. It is clay loam or loam. It is medium acid to very strongly acid.

The Gara soil in the map unit Gara-Armstrong clay loams, 9 to 14 percent slopes, severely eroded, is a taxadjunct to the Gara series because the surface layer is lighter colored than is definitive for the series.

Givin Series

The Givin series consists of somewhat poorly drained, moderately slowly permeable soils on uplands and high stream benches. These soils formed in loess. The native vegetation was mixed prairie grasses and deciduous trees. Slopes range from 0 to 3 percent.

Typical pedon of Givin silt loam, 0 to 2 percent slopes, in a cultivated field; 525 feet west and 430 feet south of the northeast corner of sec. 25, T. 74 N., R. 9 W.

Ap—0 to 7 inches; very dark gray (10YR 3/1) silt loam (21 percent clay), gray (10YR 5/1) dry; weak fine granular structure; friable; medium acid; abrupt smooth boundary.

E—7 to 13 inches; grayish brown (10YR 5/2) silt loam (20 percent clay), light gray (10YR 7/1) dry; very dark gray (10YR 3/1) coatings on faces of peds; moderate medium platy structure; friable; medium acid; clear smooth boundary.

BE—13 to 17 inches; brown (10YR 5/3) and grayish brown (10YR 5/2) silty clay loam (29 percent clay); few fine faint yellowish brown (10YR 5/6) mottles; weak fine subangular blocky structure; friable; nearly continuous light gray (10YR 7/1) dry silt coatings on faces of peds; few small dark accumulations (iron and manganese oxides); strongly acid; gradual smooth boundary.

Bt—17 to 33 inches; brown (10YR 5/3) silty clay (41 percent clay); grayish brown (10YR 5/2) coatings on faces of peds; few fine faint yellowish brown (10YR 5/4 and 5/6) mottles; moderate fine subangular blocky structure; firm; thin discontinuous dark grayish brown (10YR 4/2) clay films on faces of peds; nearly continuous light gray (10YR 7/1) dry silt coatings on faces of peds; few small dark accumulations (iron and manganese oxides); strongly acid; gradual smooth boundary.

Btg—33 to 49 inches; grayish brown (2.5Y 5/2) silty clay loam (36 percent clay); common fine distinct yellowish brown (10YR 5/4 and 5/6) mottles; weak medium prismatic structure parting to weak medium subangular blocky; firm; thin discontinuous dark grayish brown (10YR 4/2) clay films on faces of peds; nearly continuous light gray (10YR 7/1) dry silt coatings on faces of peds; common dark accumulations (iron and manganese oxides); strongly acid; gradual smooth boundary.

BC—49 to 60 inches; grayish brown (2.5Y 5/2) silty clay loam (34 percent clay); common fine distinct yellowish brown (10YR 5/4 and 5/6) mottles; weak coarse prismatic structure; friable; thin discontinuous very dark gray (10YR 3/1) clay films on faces of peds; few dark accumulations (iron and manganese oxides); strongly acid.

The solum ranges from 40 to 72 inches in thickness. It is medium acid or strongly acid.

The Ap horizon has hue of 10YR, value of 2 or 3, and chroma of 1 or 2. The E horizon is grayish brown (10YR 5/2) or dark grayish brown (10YR 4/2). The Bt horizon has hue of 10YR in the upper part and 2.5Y in the lower

part. It has value of 4 or 5 and chroma of 2 or 3. The grayer colors are more common in the lower part. This horizon has a clay content of 36 to 42 percent. The BC and C horizons have hue of 2.5Y or 5Y, value of 4 or 5, and chroma of 2.

Hedrick Series

The Hedrick series consists of moderately well drained, moderately permeable soils on upland side slopes and in coves at the head of drainageways. These soils formed in deoxidized loess. The native vegetation was mixed prairie grasses and deciduous trees. Slopes range from 2 to 9 percent.

Typical pedon of Hedrick silt loam, 5 to 9 percent slopes, moderately eroded, in a cultivated field; 500 feet south and 1,810 feet west of the northeast corner of sec. 25, T. 75 N., R. 8 W.

Ap—0 to 8 inches; very dark grayish brown (10YR 3/2) silt loam (26 percent clay), grayish brown (10YR 5/2) dry; mixed with streaks and pockets of brown (10YR 4/3) and yellowish brown (10YR 5/4) silty clay loam subsoil material; weak fine subangular blocky structure parting to weak fine granular; friable; slightly acid; abrupt smooth boundary.

Bt1—8 to 14 inches; dark yellowish brown (10YR 4/4) silty clay loam (36 percent clay); few very dark grayish brown (10YR 3/2) organic coatings on faces of peds; few fine distinct dark yellowish brown (10YR 3/4) mottles; weak medium subangular blocky structure parting to moderate fine subangular blocky; firm; thin nearly continuous brown (10YR 4/3) clay films on faces of peds; thin discontinuous light gray (10YR 7/1) dry silt coatings on faces of peds; common small soft very dark brown (10YR 2/2) accumulations (iron and manganese oxides); few very dark grayish brown (10YR 3/2) worm casts; slightly acid; clear smooth boundary.

Bt2—14 to 19 inches; brown (10YR 5/3) and yellowish brown (10YR 5/4) silty clay loam (37 percent clay); common fine distinct strong brown (7.5YR 5/6) and grayish brown (2.5Y 5/2) mottles; weak medium subangular blocky structure parting to moderate fine subangular blocky; firm; thin nearly continuous dark grayish brown (10YR 4/2) clay films on faces of peds; thin discontinuous light gray (10YR 7/1) dry silt coatings on faces of peds; few hard dark brown (7.5YR 3/2) accumulations (iron and manganese oxides); medium acid; gradual smooth boundary.

Bt3—19 to 26 inches; light brownish gray (2.5Y 6/2) and grayish brown (2.5Y 5/2) silty clay loam (34 percent clay); common medium distinct strong brown (7.5YR 5/6 and 5/8) mottles; weak fine prismatic structure parting to moderate medium subangular blocky; firm; thin nearly continuous dark gray (10YR 4/1) and dark grayish brown (10YR 4/2) clay films on faces of peds; thin discontinuous light gray (10YR 7/1) dry silt coatings on faces of peds; common small dark brown (7.5YR 3/2) accumulations (iron and manganese oxides); medium acid; gradual smooth boundary.

Bt4—26 to 32 inches; light brownish gray (2.5Y 6/2) silty clay loam (33 percent clay); common medium distinct strong brown (7.5YR 5/6 and 5/8) mottles; moderate medium prismatic structure parting to weak medium subangular blocky; friable; thin discontinuous dark grayish brown (10YR 4/2) and dark gray (10YR 4/1) clay films on faces of peds; many small dark brown (7.5YR 3/2) accumulations (iron and manganese oxides); medium acid; gradual smooth boundary.

Bt5—32 to 38 inches; light brownish gray (2.5Y 6/2) silty clay loam (32 percent clay); common medium distinct strong brown (7.5YR 5/6 and 5/8) mottles; weak medium prismatic structure; friable; thin discontinuous dark grayish brown (10YR 4/2) and dark gray (10YR 4/1) clay films on faces of peds; very dark gray (10YR 3/1) clay flows in root channels; many small dark brown (7.5YR 3/2) accumulations (iron and manganese oxides); medium acid; gradual smooth boundary.

BC—38 to 53 inches; light brownish gray (2.5Y 6/2) silty clay loam (31 percent clay); common medium distinct strong brown (7.5YR 5/6 and 5/8) mottles; weak coarse prismatic structure; friable; few very dark gray (10YR 3/1) clay flows in root channels; few medium and many small soft dark brown (7.5YR 3/2) accumulations (iron and manganese oxides); medium acid; gradual smooth boundary.

C—53 to 60 inches; light brownish gray (2.5Y 6/2) silty clay loam (27 percent clay); common medium distinct strong brown (7.5YR 5/6 and 5/8) mottles; massive; friable; few medium and many small soft dark brown (7.5YR 3/2) accumulations (iron and manganese oxides); slightly acid.

The solum ranges from 46 to 70 inches in thickness. It is slightly acid to strongly acid.

The Ap horizon has hue of 10YR, value of 3, and chroma of 1 or 2. It is silt loam or silty clay loam. Some pedons in uneroded areas have an E horizon. This horizon is grayish brown (10YR 5/2) or dark grayish brown (10YR 4/2) silt loam. The Bt1 horizon has hue of 10YR, value of 4, and chroma of 3 or 4. The Bt2 horizon has mottles with hue of 7.5YR to 5Y, value of 5 or 6, and chroma of 1 to 6. The Bt3, Bt4, and BC horizons have hue of 10YR to 5Y, value of 5 or 6, and chroma of 1 or 2. Mottles and iron accumulations that have high value and chroma are typical throughout the lower part of the B horizon. The gray colors and iron accumulations are relict features related stratigraphically to a deoxidized and leached weathering zone.

Hedrick silty clay loam, 5 to 9 percent slopes, severely eroded, is a taxadjunct to the Hedrick series because it

has a lighter colored surface layer than is definitive for the series.

Humeston Series

The Humeston series consists of very poorly drained, very slowly permeable soils in slightly concave slack-water areas on bottom land. These soils formed in silty alluvium. The native vegetation was swamp grasses, sedges, and prairie grasses that can tolerate wetness. Slopes range from 0 to 2 percent.

Typical pedon of Humeston silty clay loam, 0 to 2 percent slopes, in a cultivated field; 360 feet south and 740 feet east of the northwest corner of sec. 24, T. 74 N., R. 7 W.

Ap—0 to 7 inches; very dark gray (10YR 3/1) silty clay loam (27 percent clay), grayish brown (10YR 5/2) dry; weak fine granular structure; friable; few fibrous roots; medium acid; abrupt smooth boundary.

A—7 to 12 inches; very dark gray (10YR 3/1) silty clay loam (29 percent clay), gray (10YR 5/1) dry; common fine distinct dark brown (7.5YR 3/2) mottles; weak medium platy structure parting to weak fine subangular blocky; friable; few fibrous roots; medium acid; clear smooth boundary.

E1—12 to 16 inches; dark gray (10YR 4/1) silt loam (25 percent clay); few very dark gray (10YR 3/1) coatings on faces of peds in the upper part; common fine distinct dark brown (7.5YR 3/2) mottles; moderate medium platy structure parting to weak coarse subangular blocky; friable; light gray (10YR 7/1) dry silt coatings on faces of peds; strongly acid; clear smooth boundary.

E2—16 to 20 inches; dark gray (10YR 4/1) silt loam (25 percent clay); common fine distinct dark brown (7.5YR 3/2) mottles; moderate medium platy structure parting to weak thin platy; friable; light gray (10YR 7/1) dry silt coatings on faces of peds; strongly acid; clear smooth boundary.

Btg1—20 to 24 inches; very dark gray (10YR 3/1) and dark gray (10YR 4/1) silty clay loam (35 percent clay); moderate fine subangular blocky structure parting to weak fine angular blocky; firm; thick discontinuous black (N 2/0) clay films on faces of peds; few light gray (10YR 7/1) dry silt coatings on faces of peds; common small brown (7.5YR 4/4) concretions (iron and manganese oxides); strongly acid; clear smooth boundary.

Btg2—24 to 34 inches; very dark gray (10YR 3/1) and black (N 2/0) silty clay (47 percent clay); few fine faint dark gray (10YR 4/1) mottles; moderate coarse prismatic structure parting to moderate fine subangular blocky; very firm; thick nearly continuous black (N 2/0) clay films on faces of peds; common small brown (7.5YR 4/4) concretions (iron and manganese oxides); strongly acid; gradual smooth boundary.

Btg3—34 to 42 inches; very dark gray (10YR 3/1) silty clay (47 percent clay); few fine faint dark gray (N 4/0) mottles; moderate coarse prismatic structure parting to weak coarse prismatic; very firm; thick nearly continuous very dark gray (10YR 3/1) clay films on faces of peds; common small brown (7.5YR 4/4) concretions (iron and manganese oxides); medium acid; gradual smooth boundary.

Btg4—42 to 51 inches; dark gray (10YR 4/1) and gray (10YR 5/1) silty clay (42 percent clay); few very dark gray (10YR 3/1) coatings on faces of peds; few fine distinct yellowish brown (10YR 5/6) mottles; moderate coarse prismatic structure parting to weak coarse subangular blocky; very firm; thick nearly continuous very dark gray (10YR 3/1) clay films on faces of peds; common small brown (7.5YR 4/4) concretions (iron and manganese oxides); medium acid; gradual smooth boundary.

Btg5—51 to 60 inches; dark gray (10YR 4/1) and gray (10YR 5/1) silty clay loam (38 percent clay); common fine distinct yellowish brown (10YR 5/4) mottles; moderate coarse prismatic structure; firm; thick nearly continuous dark gray (10YR 4/1) clay films on faces of peds; few very dark gray (10YR 3/1) clay flows in root channels; medium acid.

The solum ranges from 48 to 96 inches in thickness. It is medium acid to very strongly acid.

The A horizon is 10 to 16 inches thick. It is silty clay loam or silt loam and is black (10YR 2/1) or very dark gray (10YR 3/1). It has a clay content of 24 to 30 percent. The E horizon is dark gray (10YR 4/1) or gray (10YR 5/1) and is 6 to 14 inches thick. It has a clay content of 20 to 26 percent. The Btg1 horizon has a clay content of 30 to 35 percent. It is very dark gray (10YR 3/1) or dark gray (10YR 4/1). The rest of the Btg horizon is black (N 2/0 or 10YR 2/1) or very dark gray (10YR 3/1) in the upper part and very dark gray (10YR 3/1), dark gray (10YR 4/1), or gray (10YR 5/1) in the lower part. It has a clay content of 35 to 48 percent.

Inton Series

The Inton series consists of moderately well drained, moderately permeable soils on upland side slopes and in coves at the head of drainageways. These soils formed in deoxidized loess. The native vegetation was deciduous trees. Slopes range from 2 to 9 percent.

Typical pedon of Inton silt loam, 2 to 5 percent slopes, in a hayfield; 1,220 feet south and 170 feet east of the northwest corner of sec. 26, T. 74 N., R. 6 W.

Ap—0 to 5 inches; dark grayish brown (10YR 4/2) silt loam (25 percent clay), light brownish gray (10YR 6/2) dry; few streaks and pockets of yellowish brown (10YR 5/4) silty clay loam subsoil material; weak fine subangular blocky structure parting to

weak fine granular; friable; few small dark accumulations (iron and manganese oxides); medium acid; abrupt smooth boundary.

Bt1—5 to 12 inches; yellowish brown (10YR 5/4) silty clay loam (35 percent clay); common dark grayish brown (10YR 4/2) coatings on faces of peds; moderate fine angular blocky structure; friable; thin patchy brown (10YR 4/3) clay films on faces of peds; thick nearly continuous white (10YR 8/2) dry silt coatings on faces of peds; common fine roots; few small dark accumulations (iron and manganese oxides); strongly acid; gradual smooth boundary.

Bt2—12 to 18 inches; yellowish brown (10YR 5/4) silty clay loam (37 percent clay); few fine distinct grayish brown (2.5Y 5/2), strong brown (7.5YR 5/6), and reddish brown (5YR 4/4) mottles; moderate medium angular blocky structure; firm; thin nearly continuous dark grayish brown (10YR 4/2) and brown (10YR 5/3) clay films on faces of peds; thick nearly continuous white (10YR 8/2) dry silt coatings on faces of peds; common fine roots; few small dark accumulations (iron and manganese oxides); strongly acid; gradual smooth boundary.

Bt3—18 to 23 inches; grayish brown (2.5Y 5/2) and brown (10YR 5/3) silty clay loam (33 percent clay); common fine prominent strong brown (7.5YR 5/6) and few fine prominent reddish brown (5YR 4/4) mottles; moderate medium angular blocky structure; firm; thin discontinuous dark grayish brown (10YR 4/2) clay films on faces of peds; thick discontinuous white (10YR 8/2) dry silt coatings on faces of peds; common medium dark accumulations (iron and manganese oxides); strongly acid; gradual smooth boundary.

Bt4—23 to 33 inches; grayish brown (2.5Y 5/2) and light brownish gray (2.5Y 6/2) silty clay loam (32 percent clay); common fine prominent strong brown (7.5YR 5/6) and few fine prominent reddish brown (5YR 4/4) mottles; weak fine prismatic structure parting to weak fine angular blocky; firm; thin discontinuous dark grayish brown (10YR 4/2) clay films on faces of peds; many medium dark concretions (iron and manganese oxides); strongly acid; gradual smooth boundary.

BC—33 to 49 inches; light brownish gray (2.5Y 6/2) silty clay loam (30 percent clay); common fine prominent strong brown (7.5YR 5/6) and few fine prominent reddish brown (5YR 4/4) mottles; weak medium prismatic structure; friable; thin patchy very dark grayish brown (10YR 3/2) clay films on vertical faces of prisms; many large dark concretions (iron and manganese oxides); strongly acid; gradual smooth boundary.

C—49 to 60 inches; light brownish gray (2.5Y 6/2) silt loam (26 percent clay); common fine prominent strong brown (7.5YR 5/6) and few fine prominent reddish brown (5YR 4/4) mottles; massive with vertical cleavage; friable; many large dark concretions (iron and manganese oxides); medium acid.

The solum ranges from 30 to 50 inches in thickness. It is medium acid or strongly acid. The matrix colors have hue of 2.5Y or 5Y and chroma of 2 or less within 30 inches of the surface.

The Ap horizon is brown (10YR 4/3) or dark grayish brown (10YR 4/2) silt loam or silty clay loam. The Bt1 horizon has hue of 10YR, value of 4 or 5, and chroma of 3 or 4. The clay content in the Bt horizon is 32 to 35 percent. It is as much as 38 percent in any subhorizon. The Bt2 and Bt3 horizons are mottled and have matrix colors with hue of 10YR or 2.5Y, value of 4 to 6, and chroma of 2 to 4. The Bt4 and BC horizons are mottled and have matrix colors with hue of 2.5Y or 5Y, value of 4 to 6, and chroma of 2 to 4.

Jackson Series

The Jackson series consists of moderately well drained soils on low stream terraces. These soils formed in silty alluvial sediments and in the underlying stratified sandy deposits. The native vegetation was deciduous trees. Permeability is moderate in the upper part of the profile and rapid in the lower part. Slopes range from 0 to 2 percent.

Typical pedon of Jackson silt loam, 0 to 2 percent slopes, in an area of pasture; 2,120 feet east and 1,080 feet north of the southwest corner of sec. 17, T. 77 N., R. 7 W.

Ap—0 to 6 inches; very dark grayish brown (10YR 3/2) silt loam (20 percent clay), light brownish gray (10YR 6/2) dry; mixed with a small amount of brown (10YR 4/3) silt loam; very dark gray (10YR 3/1) coatings on faces of peds; weak fine granular structure; friable; neutral; abrupt smooth boundary.

E—6 to 12 inches; dark grayish brown (10YR 4/2) and brown (10YR 4/3) silt loam (16 percent clay), light brownish gray (10YR 6/2) dry; few very dark gray (10YR 3/1) coatings on faces of peds; weak thin platy structure parting to weak fine granular; friable; neutral; gradual smooth boundary.

BE—12 to 19 inches; brown (10YR 4/3) silt loam (17 percent clay); weak thin platy structure parting to moderate fine subangular blocky; friable; few thin discontinuous light gray (10YR 7/1) dry silt coatings on faces of peds; very dark gray (10YR 3/1) root channels; medium acid; gradual smooth boundary.

Bt1—19 to 29 inches; dark yellowish brown (10YR 4/4) and brown (10YR 5/3) silt loam (21 percent clay); moderate fine subangular blocky structure; friable; thin discontinuous clay films on faces of peds; few thin discontinuous light gray (10YR 7/1) dry silt

coatings on faces of peds; medium acid; gradual smooth boundary.

Bt2—29 to 40 inches; dark yellowish brown (10YR 4/4) silt loam (19 percent clay); few fine faint light brownish gray (10YR 6/2) and few fine distinct brown (7.5YR 4/4) mottles; moderate fine subangular blocky structure; friable; thin discontinuous clay films on faces of peds; common thin discontinuous light gray (10YR 7/1) dry silt coatings on faces of peds; medium acid; gradual smooth boundary.

2BC—40 to 51 inches; brown (7.5YR 4/4) and strong brown (7.5YR 5/8) stratified silt loam, loam, and fine sandy loam; common medium distinct grayish brown (10YR 5/2) mottles; weak medium and weak coarse subangular blocky structure; friable; many thin discontinuous light gray (10YR 7/1) dry silt coatings on faces of peds; medium acid; gradual wavy boundary.

2C—51 to 60 inches; brown (7.5YR 4/4) and strong brown (7.5YR 5/8) stratified fine sandy loam, loam, and sand; common medium distinct grayish brown (10YR 5/2) mottles; single grained; loose; many thin discontinuous light gray (10YR 7/1) dry silt coatings on faces of peds; medium acid.

The solum ranges from 40 to 65 inches in thickness. It is neutral to medium acid in the upper part and slightly acid to strongly acid in the lower part.

The Ap horizon has hue of 10YR, value of 3 or 4, and chroma of 2 or 3. The Bt horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 3 or 4. It is silt loam or silty clay loam. The control section has a clay content of 18 to 30 percent. The 2C horizon has hue of 10YR or 7.5YR, value of 4 to 6, and chroma of 2 to 8. The part of the 2C horizon below a depth of 60 inches is fine sand, sand, or loamy sand.

Kalona Series

The Kalona series consists of poorly drained, moderately slowly permeable soils on broad upland divides. These soils formed in loess. The native vegetation was sedges and prairie grasses that can tolerate wetness. Slopes range from 0 to 2 percent.

Typical pedon of Kalona silty clay loam, 0 to 2 percent slopes, in a cultivated field; 2,540 feet south and 100 feet east of the center of sec. 7, T. 76 N., R. 7 W.

Ap—0 to 7 inches; black (10YR 2/1) silty clay loam (36 percent clay), very dark gray (10YR 3/1) dry; weak fine granular structure; firm; neutral; clear smooth boundary.

A1—7 to 13 inches; black (N 2/0) silty clay loam (39 percent clay), very dark gray (10YR 3/1) dry; moderate fine granular structure; firm; neutral; gradual smooth boundary.

A2—13 to 19 inches; black (N 2/0) silty clay loam (39 percent clay), dark gray (10YR 4/1) dry; moderate very fine subangular and angular blocky structure; firm; neutral; gradual smooth boundary.

BA—19 to 23 inches; dark gray (5Y 4/1) silty clay (40 percent clay), grayish brown (2.5Y 5/2) dry; black (5Y 2/2) coatings on faces of peds; few fine distinct yellowish brown (10YR 5/4) mottles; weak medium prismatic structure parting to medium and fine subangular blocky; firm; few brown (7.5YR 4/4) and strong brown (7.5YR 5/6) accumulations (iron and manganese oxides); neutral; gradual smooth boundary.

Bg1—23 to 30 inches; dark grayish brown (2.5Y 4/2) and dark gray (10YR 4/1) silty clay (42 percent clay); very dark gray (5Y 3/1) coatings on faces of peds; common fine distinct yellowish brown (10YR 5/4) mottles; moderate medium prismatic structure parting to moderate medium and fine subangular blocky; firm; many strong brown (7.5YR 5/6) accumulations (iron and manganese oxides); neutral; gradual smooth boundary.

Bg2—30 to 37 inches; grayish brown (2.5Y 5/2) silty clay loam (36 percent clay); few dark gray (10YR 4/1) coatings on faces of peds; common fine distinct yellowish brown (10YR 5/6) mottles; moderate medium prismatic structure parting to moderate medium subangular blocky; firm; few dark brown (10YR 3/3) accumulations (iron and manganese oxides); neutral; gradual smooth boundary.

BCg—37 to 48 inches; olive gray (5Y 5/2) silty clay loam (34 percent clay); common fine and medium prominent strong brown (7.5YR 5/6) mottles; moderate medium prismatic structure parting to weak medium subangular blocky; firm; few dark brown (10YR 3/3) accumulations (iron and manganese oxides); neutral; gradual smooth boundary.

Cg—48 to 60 inches; light olive gray (5Y 6/2) and gray (5Y 5/1) silty clay loam (28 percent clay); common fine prominent strong brown (7.5YR 5/6 and 5/8) mottles; massive; friable; very few dark brown (10YR 3/3) accumulations and few medium black (5YR 2/1) concretions (iron and manganese oxides); neutral.

The solum ranges from 40 to 72 inches in thickness. The clay content is 35 to 40 percent in the 10- to 40-inch control section. It is more than 35 percent in the A horizon.

The A horizon is black (N 2/0 or 10YR 2/1). The Bg horizon has hue of 10YR to 5Y, value of 4 or 5, and chroma of 1 or 2. The Bg horizon is silty clay loam or silty clay. It is medium acid to neutral. The Cg horizon has hue of 5Y, value of 4 to 6, and chroma of 1 or 2. It is silt loam or silty clay loam.

Keomah Series

The Keomah series consists of somewhat poorly drained, slowly permeable soils on upland divides and high stream benches. These soils formed in loess. The native vegetation was deciduous trees. Slopes range from 0 to 3 percent.

Typical pedon of Keomah silt loam, 0 to 2 percent slopes, in a cultivated field; 660 feet east and 50 feet north of the center of sec. 9, T. 75 N., R. 9 W.

Ap—0 to 7 inches; dark gray (10YR 4/1) silt loam, gray (10YR 6/1) dry; weak fine granular structure; friable; medium acid; abrupt smooth boundary.

E1—7 to 10 inches; dark gray (10YR 4/1) and dark grayish brown (10YR 4/2) silt loam, gray (10YR 6/1) and light brownish gray (10YR 6/2) dry; few fine distinct brown (7.5YR 4/4) mottles; weak thin platy structure; friable; few worm casts; medium acid; clear smooth boundary.

E2—10 to 12 inches; grayish brown (10YR 5/2) silt loam, light gray (10YR 7/2) dry; dark gray (10YR 4/1) coatings on horizontal faces of peds; few fine distinct brown (7.5YR 4/4) mottles; weak thin platy structure parting to weak fine subangular blocky; friable; medium acid; clear smooth boundary.

BE—12 to 16 inches; brown (10YR 5/3) silty clay loam; dark grayish brown (10YR 4/2) and dark yellowish brown (10YR 4/4) coatings on faces of peds; few fine distinct dark gray (10YR 4/1) mottles; moderate fine and very fine subangular blocky structure; friable; thick distinct light brownish gray (10YR 6/2) dry silt coatings on faces of peds; few fine concretions (iron and manganese oxides); strongly acid; gradual smooth boundary.

Bt1—16 to 24 inches; brown (10YR 5/3) silty clay; dark grayish brown (10YR 4/2) coatings on faces of peds; moderate fine subangular blocky structure; firm; thick discontinuous clay films; thin distinct light brownish gray (10YR 6/2) dry silt coatings on faces of peds; few fine concretions (iron and manganese oxides); strongly acid; gradual smooth boundary.

Bt2—24 to 30 inches; brown (10YR 5/3) and grayish brown (10YR 5/2) silty clay; dark grayish brown (10YR 4/2) coatings on faces of peds; few fine distinct strong brown (7.5YR 5/6) mottles; weak medium prismatic structure parting to moderate fine subangular blocky; firm; nearly continuous dark grayish brown (10YR 4/2) clay films on faces of peds; few silt coatings on faces of prisms; strongly acid; gradual smooth boundary.

Bt3—30 to 37 inches; brown (10YR 5/3) and grayish brown (2.5Y 5/2) silty clay loam; dark grayish brown (2.5Y 4/2) coatings on faces of peds; common fine distinct strong brown (7.5YR 5/6) and common fine faint yellowish brown (10YR 5/8) mottles; weak medium prismatic structure parting to moderate medium angular blocky; firm; thick discontinuous clay films on faces of peds; strongly acid; gradual smooth boundary.

BC—37 to 47 inches; grayish brown (2.5Y 5/2) and brown (10YR 5/3) silty clay loam; common medium distinct strong brown (7.5YR 5/6) and yellowish brown (10YR 5/8) mottles; weak medium prismatic structure; friable; few thin discontinuous clay films on faces of peds and in pores; few fine concretions (iron and manganese oxides); strongly acid; gradual smooth boundary.

Cg—47 to 60 inches; olive gray (5Y 5/2) silty clay loam; common medium prominent strong brown (7.5YR 5/6) mottles; some vertical cleavage; friable; few fine concretions (iron and manganese oxides); slightly acid.

The solum ranges from 40 to 76 inches in thickness. It is medium acid to very strongly acid.

The Ap horizon has hue of 10YR, value of 4, and chroma of 1 or 2. The E horizon is dark grayish brown (10YR 4/2), dark gray (10YR 4/1), grayish brown (10YR 5/2), or brown (10YR 5/3). The Bt horizon is silty clay loam or silty clay. It has hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 2 to 4. As depth increases, hue grades from 10YR to 2.5Y and chroma of 2 becomes more dominant.

Keswick Series

The Keswick series consists of somewhat poorly drained, slowly permeable soils on upland nose slopes and side slopes. These soils formed in a Late Sangamon paleosol that formed in glacial till. The native vegetation was deciduous trees. Slopes range from 9 to 18 percent.

Typical pedon of Keswick silt loam, 9 to 14 percent slopes, moderately eroded, in a cultivated field; 2,100 feet south and 200 feet east of the center of sec. 28, T. 74 N., R. 6 W.

Ap—0 to 5 inches; very dark grayish brown (10YR 3/2) and dark grayish brown (10YR 4/2) silt loam, pale brown (10YR 6/3) dry; mixed with streaks and pockets of brown (10YR 5/3) silty clay loam subsoil material; weak fine granular structure; friable; slightly acid; abrupt smooth boundary.

BE—5 to 8 inches; brown (10YR 5/3) silty clay loam; dominantly weak fine subangular blocky structure but platy structure in the upper 1 inch; friable; common discontinuous white (10YR 8/2) dry silt coatings on faces of peds; slightly acid; gradual smooth boundary.

2Bt1—8 to 15 inches; brown (10YR 5/3) clay; brown (10YR 4/3) coatings on faces of peds; few fine faint grayish brown (10YR 5/2) and common fine prominent dark reddish brown (2.5YR 3/4) and dusky red (2.5YR 3/2) mottles; moderate medium and weak fine subangular blocky structure; very firm;

thin discontinuous clay films on faces of peds; weak stone line at top of horizon; medium acid; gradual smooth boundary.

2Bt2—15 to 22 inches; dark reddish brown (2.5YR 3/4) and grayish brown (2.5Y 5/2) clay; common medium distinct grayish brown (10YR 5/2) and few fine distinct yellowish brown (10YR 5/6) mottles; moderate fine subangular blocky structure; very firm; thin discontinuous dark yellowish brown (10YR 4/4) clay films on faces of peds; medium acid; gradual smooth boundary.

2Bt3—22 to 28 inches; dark reddish brown (2.5YR 3/4), gray (10YR 6/1), grayish brown (2.5Y 5/2), and dark yellowish brown (10YR 4/4) clay; few fine distinct yellowish brown (10YR 5/6) mottles; moderate medium subangular blocky structure; very firm; thin discontinuous clay films on faces of peds; about 2 percent small pebbles; medium acid; gradual smooth boundary.

2Bt4—28 to 42 inches; grayish brown (10YR 5/2) and gray (10YR 6/1) clay loam; few medium prominent dark reddish brown (2.5YR 3/4) mottles in the upper part and common medium prominent strong brown (7.5YR 5/6) mottles throughout; weak medium prismatic structure parting to moderate medium subangular blocky; very firm; thick discontinuous dark gray (10YR 4/1) clay films on faces of peds; about 5 percent pebbles; medium acid; gradual smooth boundary.

2BC—42 to 60 inches; light gray (10YR 7/2) clay loam; common large distinct strong brown (7.5YR 5/6 and 5/8) mottles; moderate medium prismatic structure; firm; thick discontinuous dark gray (10YR 4/1) and very dark gray (10YR 3/1) clay films on faces of peds; gray (10YR 5/1) clay flows in root channels; about 5 percent pebbles; medium acid.

The solum ranges from 42 to 75 inches in thickness. It is slightly acid to very strongly acid.

The Ap horizon has hue of 10YR, value of 3 or 4, and chroma of 2 or 3. It is silt loam, loam, or clay loam. Uneroded pedons have an A horizon with hue of 10YR, value of 2 or 3, and chroma of 1 or 2. They also have an E horizon, which is 6 to 12 inches thick. The 2Bt horizon is clay or clay loam. The upper part has hue of 2.5YR to 10YR, value of 4 or 5, and chroma of 3 to 6. It has grayish brown and gray mottles. The lower part of the 2Bt horizon and the 2BC horizon have hue of 10YR, 7.5YR, or 5Y, value of 4 to 7, and chroma of 1 to 6.

Koszta Series

The Koszta series consists of somewhat poorly drained, moderately permeable soils on stream terraces. These soils formed in silty alluvium. The native vegetation was mixed prairie grasses and deciduous trees. Slopes range from 0 to 2 percent.

Typical pedon of Koszta silt loam, 0 to 2 percent slopes, in a cultivated field; 2,000 feet east and 95 feet north of the center of sec. 21, T. 77 N., R. 7 W.

Ap—0 to 8 inches; very dark grayish brown (10YR 3/2) silt loam, grayish brown (10YR 5/2) dry; very dark gray (10YR 3/1) coatings on faces of peds; weak fine granular structure; friable; slightly acid; abrupt smooth boundary.

E—8 to 14 inches; dark grayish brown (10YR 4/2) silt loam; very dark gray (10YR 3/1) coatings on faces of peds; weak medium platy structure parting to weak fine granular; friable; medium acid; clear smooth boundary.

BE—14 to 20 inches; brown (10YR 5/3) and grayish brown (10YR 5/2) silty clay loam; few fine faint yellowish brown (10YR 5/6) mottles; weak fine subangular blocky structure; friable; thin discontinuous light gray (10YR 7/2) dry silt coatings on faces of peds; few soft black accumulations (iron and manganese oxides); medium acid; gradual smooth boundary.

Btg1—20 to 32 inches; grayish brown (2.5Y 5/2) and light olive brown (2.5Y 5/4) silty clay loam; few fine distinct strong brown (7.5YR 4/6) and common fine distinct yellowish brown (10YR 5/6) mottles; weak fine prismatic structure parting to moderate fine subangular blocky; firm; thin nearly continuous dark grayish brown (10YR 4/2) clay films on faces of peds; thin discontinuous light gray (10YR 7/2) dry silt coatings on faces of peds; few soft black accumulations (iron and manganese oxides); strongly acid; gradual smooth boundary.

Btg2—32 to 41 inches; grayish brown (2.5Y 5/2) and light brownish gray (2.5Y 6/2) silty clay loam; few fine distinct strong brown (7.5YR 4/6) and common fine distinct yellowish brown (10YR 5/6) mottles; weak fine prismatic structure parting to weak medium subangular blocky; firm; thin discontinuous dark grayish brown (10YR 4/2) clay films on faces of peds; thin discontinuous light gray (10YR 7/2) dry silt coatings on faces of peds; few soft black (10YR 2/1) accumulations (iron and manganese oxides); few small soft dark spherical clay accumulations; strongly acid; gradual smooth boundary.

Btg3—41 to 51 inches; light brownish gray (2.5Y 6/2) silty clay loam; common fine distinct strong brown (7.5YR 4/6) and few fine distinct yellowish brown (10YR 5/6) mottles; moderate medium prismatic structure; firm; few thin discontinuous grayish brown (2.5Y 5/2) clay films on faces of peds; thin discontinuous light gray (10YR 7/2) dry silt coatings on faces of peds; few soft black (10YR 2/1) accumulations (iron and manganese oxides); few medium soft dark spherical clay accumulations; medium acid; gradual smooth boundary.

Cg—51 to 60 inches; light brownish gray (2.5Y 6/2) silty clay loam; common fine distinct strong brown (7.5YR 4/6) mottles; massive with some vertical cleavage; firm; thin discontinuous light gray (10YR 7/2) dry silt coatings on faces of peds; common medium soft dark accumulations (iron and manganese oxides); medium acid.

The solum ranges from 36 to 60 inches in thickness. It is slightly acid to strongly acid.

The Ap horizon has hue of 10YR, value of 2 or 3, and chroma of 1 or 2. The E horizon has hue of 10YR, value of 4 or 5, and chroma of 2. In 40 percent or more of some horizons between the base of the Ap or A horizon and a depth of 30 inches, chroma is more than 2. The Btg horizon has a clay content of 28 to 35 percent. It has hue of 10YR or 2.5Y, value of 4 to 6, and chroma of 2 to 4. The Cg horizon has hue of 10YR or 2.5Y, value of 4 to 6, and chroma of 2 to 6. The C horizon is dominantly silty clay loam but has thin strata of coarser textured material in some pedons.

Ladoga Series

The Ladoga series consists of moderately well drained, moderately slowly permeable soils on uplands and high stream benches. These soils formed in loess. The native vegetation was mixed prairie grasses and deciduous trees. Slopes range from 2 to 14 percent.

Typical pedon of Ladoga silt loam, 2 to 5 percent slopes, in a cultivated field; 720 feet west and 210 feet north of the southeast corner of sec. 5, T. 76 N., R. 7 W.

Ap—0 to 8 inches; very dark brown (10YR 2/2) silt loam (26 percent clay), brown (10YR 5/3) dry; weak fine granular structure; friable; slightly acid; abrupt smooth boundary.

Bt1—8 to 12 inches; brown (10YR 4/3) silty clay loam (35 percent clay); weak fine subangular blocky structure; friable; few dark brown (10YR 3/3) accumulations (iron and manganese oxides); strongly acid; clear smooth boundary.

Bt2—12 to 23 inches; brown (10YR 4/3) silty clay loam (40 percent clay); moderate fine subangular and angular blocky structure; firm; thin discontinuous clay films on faces of peds; few light gray (10YR 7/2) dry silt coatings on faces of peds; few dark brown (10YR 3/3) accumulations (iron and manganese oxides); strongly acid; gradual smooth boundary.

Bt3—23 to 33 inches; yellowish brown (10YR 5/4) silty clay loam (36 percent clay); dark yellowish brown (10YR 4/4) coatings on faces of peds; many fine faint yellowish brown (10YR 5/6) and strong brown (7.5YR 5/6) mottles; moderate medium angular and subangular blocky structure; firm; thin discontinuous clay films on faces of peds; common light gray (10YR 7/2) dry silt coatings on faces of peds; few dark brown (10YR 3/3) accumulations (iron and manganese oxides); strongly acid; gradual smooth boundary.

Bt4—33 to 39 inches; yellowish brown (10YR 5/4) silty clay loam (34 percent clay); common medium distinct strong brown (7.5YR 5/6) and few fine faint grayish brown (10YR 5/2) mottles; moderate medium prismatic structure; friable; thin discontinuous brown (10YR 5/3) clay films on faces of peds; common light gray (10YR 7/1) dry silt coatings on faces of peds; few dark brown (10YR 3/3) accumulations (iron and manganese oxides); strongly acid; gradual smooth boundary.

BC—39 to 53 inches; yellowish brown (10YR 5/4) silty clay loam (30 percent clay); common fine distinct grayish brown (2.5Y 5/2) and common medium distinct strong brown (7.5YR 5/6) mottles; moderate coarse prismatic structure; friable; common light gray (10YR 7/2) dry silt coatings on faces of peds; few clay flows in root channels; few dark brown (10YR 3/3) accumulations (iron and manganese oxides); strongly acid; gradual smooth boundary.

C—53 to 60 inches; yellowish brown (10YR 5/6 and 5/4) and light brownish gray (10YR 6/2) silty clay loam (28 percent clay); common fine distinct strong brown (7.5YR 5/6) mottles; massive with some vertical cleavage; friable; common light gray (10YR 7/2) dry silt coatings along vertical cleavage planes; few clay flows in root channels; few dark brown (10YR 3/3) accumulations (iron and manganese oxides); medium acid.

The solum ranges from 36 to 72 inches in thickness. The Ap horizon has hue of 10YR, value of 2 or 3, and chroma of 1 or 2. It is dominantly silt loam but in some pedons is silty clay loam. Some pedons have an E horizon. This horizon has hue of 10YR, value of 4 or 5, and chroma of 2. The Bt horizon has value of 4 or 5 and chroma of 3 or 4. It has few or common grayish mottles in the lower part. In some pedons the matrix is light brownish gray (2.5Y 6/2) or grayish brown (2.5Y 5/2) below a depth of 36 inches. The Bt horizon is medium acid or strongly acid.

Ladoga silty clay loam, 5 to 9 percent slopes, severely eroded, and Ladoga silty clay loam, 9 to 14 percent slopes, severely eroded, are taxadjuncts to the Ladoga series because they have a lighter colored surface horizon than is definitive for the series.

Lamont Series

The Lamont series consists of well drained soils on upland side slopes and ridges. These soils formed in eolian material. The native vegetation was deciduous trees. Permeability is moderately rapid in the upper part of the profile and rapid in the lower part. Slopes range from 5 to 25 percent.

Typical pedon of Lamont fine sandy loam, in a pastured area of Clinton-Lamont-Chelsea complex, 5 to 9 percent slopes, moderately eroded; 1,140 feet east and 480 feet south of the center of sec. 21, T. 77 N., R. 7 W.

A—0 to 4 inches; very dark grayish brown (10YR 3/2) fine sandy loam, grayish brown (10YR 5/2) dry; weak fine granular structure; friable; many fine roots; medium acid; clear smooth boundary.

E—4 to 10 inches; dark grayish brown (10YR 4/2) fine sandy loam; mixed with some streaks and pockets of brown (10YR 4/3) subsoil material; few very dark grayish brown (10YR 3/2) organic coatings from the surface layer; weak medium platy structure; friable; medium acid; clear smooth boundary.

BE—10 to 15 inches; brown (10YR 4/3) and dark yellowish brown (10YR 4/4) fine sandy loam; few dark grayish brown (10YR 4/2) coatings on faces of peds; weak medium subangular blocky structure; friable; medium acid; gradual smooth boundary.

Bt—15 to 30 inches; strong brown (7.5YR 5/6) fine sandy loam; moderate medium subangular blocky structure; few thin discontinuous brown (10YR 4/3) clay films on faces of peds; friable; medium acid; gradual smooth boundary.

BC—30 to 38 inches; strong brown (7.5YR 5/6) loamy fine sand; massive; very friable; medium acid; gradual smooth boundary.

E&Bt—38 to 60 inches; strong brown (7.5YR 5/6) loamy fine sand; massive; very friable; 1-inch-thick lamellae of strong brown (7.5YR 5/8) sandy loam at depths of 38 and 43 inches; strongly acid.

The solum ranges from 30 to more than 60 inches in thickness. It is medium acid or strongly acid.

The A horizon has hue of 10YR, value of 3 or 4, and chroma of 1 or 2. If the value is 3, this horizon is less than 6 inches thick. Pedons in cultivated areas have a dark grayish brown (10YR 4/2) Ap horizon. The BE and Bt horizons have hue of 10YR or 7.5YR, value of 4 to 6, and chroma of 3 to 6. The Bt horizon is fine sandy loam, loam, or sandy clay loam. The BC and E&Bt horizons are loamy fine sand, loamy sand, or sand. The lamellae in the E&Bt horizon total less than 6 inches thick within a depth of 60 inches.

Lawson Series

The Lawson series consists of somewhat poorly drained, moderately permeable soils on flood plains along the major streams. These soils formed in silty alluvium. The native vegetation was mixed prairie grasses. Slopes range from 0 to 2 percent.

Typical pedon of Lawson silt loam, 0 to 2 percent slopes, in an area of permanent pasture; 200 feet west and 1,340 feet north of the southeast corner of sec. 17, T. 75 N., R. 6 W.

A1—0 to 13 inches; very dark grayish brown (10YR 3/2) silt loam, gray (10YR 5/1) dry; very dark gray (10YR 3/1) coatings on faces of peds; weak fine granular structure; friable; neutral; gradual smooth boundary.

A2—13 to 25 inches; black (10YR 2/1) silt loam, dark gray (10YR 4/1) dry; weak fine granular structure; friable; neutral; gradual smooth boundary.

A3—25 to 34 inches; very dark gray (10YR 3/1) and black (10YR 2/1) silt loam, gray (10YR 5/1) and dark gray (10YR 4/1) dry; weak fine subangular blocky structure parting to weak fine granular; friable; neutral; gradual smooth boundary.

AC—34 to 43 inches; dark grayish brown (10YR and 2.5Y 4/2) silt loam; few very dark gray (10YR 3/1) coatings on faces of peds; weak fine subangular blocky structure; friable; slightly acid; gradual smooth boundary.

C1—43 to 55 inches; grayish brown (2.5Y 5/2) and gray (10YR 5/1) silt loam; few fine distinct yellowish brown (10YR 5/6 and 5/8) mottles; massive; friable; slightly acid; gradual smooth boundary.

C2—55 to 60 inches; light brownish gray (2.5Y 6/2) silt loam interlayered with thin lenses of sandy loam; common medium distinct yellowish brown (10YR 5/6 and 5/8) mottles; massive; friable; common dark accumulations (iron and manganese oxides); slightly acid.

The solum is slightly acid or neutral. The A horizon is silt loam or silty clay loam 24 to 36 inches thick. It has hue of 10YR, value of 2 or 3, and chroma of 1 or 2. Some pedons are stratified with loam below the A horizon and within a depth of 40 inches. Strata containing more sand are common below a depth of 40 inches. The control section has a clay content of 18 to 30 percent. The C horizon has hue of 10YR or 2.5Y, value of 4 to 6, and chroma of 1 to 3.

Lindley Series

The Lindley series consists of well drained, moderately slowly permeable soils on side slopes and nose slopes in the uplands. These soils formed in glacial till. The native vegetation was deciduous trees. Slopes range from 9 to 40 percent.

Typical pedon of Lindley loam, 9 to 14 percent slopes, moderately eroded, in an area of pasture; 880 feet east and 240 feet north of the southwest corner of sec. 9, T. 76 N., R. 6 W.

Ap—0 to 6 inches; dark grayish brown (10YR 4/2) loam, light brownish gray (10YR 6/2) dry; mixed with streaks and pockets of strong brown (7.5YR 5/6) clay loam subsoil material; few very dark grayish brown (10YR 3/2) coatings on faces of peds; weak fine granular structure; friable; few small pebbles; slightly acid; abrupt smooth boundary.

Bt1—6 to 12 inches; strong brown (7.5YR 5/6) clay loam; mixed with a small amount of brown (10YR 5/3) and dark grayish brown (10YR 4/2) material; weak fine subangular blocky structure parting to weak fine granular; firm; thin discontinuous clay films on faces of peds; few small pebbles; medium acid; clear smooth boundary.

Bt2—12 to 20 inches; strong brown (7.5YR 5/6) clay loam; moderate fine subangular and angular blocky structure; firm; thin nearly continuous clay films on faces of peds; few small pebbles; strongly acid; gradual smooth boundary.

Bt3—20 to 26 inches; strong brown (7.5YR 5/6) clay loam; moderate medium angular and subangular blocky structure; firm; thin nearly continuous clay films on faces of peds; few small pebbles; strongly acid; gradual smooth boundary.

Bt4—26 to 36 inches; strong brown (7.5YR 5/6) and brown (7.5YR 5/4) clay loam; moderate coarse subangular blocky structure parting to moderate medium angular blocky; firm; thin discontinuous clay films on faces of peds; few very dark gray (10YR 3/1) accumulations (iron and manganese oxides); few small pebbles; strongly acid; gradual smooth boundary.

Bt5—36 to 49 inches; yellowish brown (10YR 5/4 and 5/6) and strong brown (7.5YR 5/6) clay loam; moderate medium prismatic structure; firm; thin discontinuous clay films on faces of peds; common dark brown (10YR 3/3) and very dark gray (10YR 3/1) accumulations (iron and manganese oxides); calcium carbonate accumulations at the base of the horizon; few small pebbles; slightly acid; gradual smooth boundary.

C—49 to 60 inches; yellowish brown (10YR 5/6) clay loam; few fine faint strong brown (7.5YR 5/8) mottles; massive; firm; few calcium carbonate accumulations; few small pebbles; slight effervescence; mildly alkaline.

The solum ranges from 35 to 50 inches in thickness. It is slightly acid to very strongly acid. The C horizon is slightly acid to mildly alkaline.

The Ap horizon has hue of 10YR, value of 4 or 5, and chroma of 2 to 4. The A horizon, if it occurs, is very dark gray (10YR 3/1), very dark grayish brown (10YR 3/2), or dark grayish brown (10YR 4/2). The Ap and A horizons are loam, clay loam, or silt loam. Pedons in uncultivated areas have an E horizon. This horizon has hue of 10YR, value of 4 to 6, and chroma of 2 to 4. The Bt horizon has hue of 7.5YR or 10YR, value of 4 or 5, and chroma of 4 to 6. In some pedons it has low-chroma mottles in the lower part. It is clay loam or loam.

Mahaska Series

The Mahaska series consists of somewhat poorly drained, moderately permeable soils on uplands and high stream benches. These soils formed in loess. The native vegetation was mixed prairie grasses. Slopes range from 0 to 3 percent.

Typical pedon of Mahaska silty clay loam, 0 to 2 percent slopes, in a cultivated field; 1,252 feet east and 445 feet north of the southwest corner of sec. 22, T. 76 N., R. 8 W.

Ap—0 to 8 inches; black (10YR 2/1) silty clay loam (31 percent clay), dark gray (10YR 4/1) dry; weak medium subangular blocky structure parting to weak very fine granular; friable; medium acid; abrupt smooth boundary.

A1—8 to 13 inches; black (10YR 2/1) silty clay loam (35 percent clay), dark gray (10YR 4/1) dry; weak fine subangular blocky structure parting to moderate fine and very fine granular; firm; strongly acid; clear smooth boundary.

A2—13 to 17 inches; very dark grayish brown (10YR 3/2) silty clay loam (37 percent clay), gray (10YR 5/1) dry; very dark gray (10YR 3/1) coatings on faces of peds; moderate very fine subangular blocky structure parting to moderate fine granular; firm; strongly acid; clear smooth boundary.

Bt1—17 to 23 inches; dark grayish brown (10YR 4/2) silty clay loam (38 percent clay); very dark grayish brown (10YR 3/2) coatings on faces of peds; moderate very fine subangular blocky structure parting to moderate fine granular; firm; strongly acid; gradual smooth boundary.

Bt2—23 to 30 inches; light olive brown (2.5Y 5/3) and dark grayish brown (2.5Y 4/2) silty clay loam (39 percent clay); few very dark grayish brown (10YR 3/2) coatings on faces of peds; few fine faint light olive brown (2.5Y 5/6) mottles; moderate fine and very fine subangular blocky structure; firm; few thin discontinuous dark grayish brown (10YR 4/2) clay films on faces of peds; strongly acid; gradual smooth boundary.

Bt3—30 to 35 inches; light olive gray (5Y 6/2) silty clay loam (36 percent clay); olive gray (5Y 5/2) coatings on faces of peds; common fine distinct yellowish brown (10YR 5/6) and few fine distinct dark brown (7.5YR 4/4) mottles; weak fine prismatic structure parting to moderate fine subangular blocky; firm; few thin discontinuous dark gray (10YR 4/1) clay films on faces of peds; common fine strong brown (7.5YR 5/8) soft accumulations (iron and manganese oxides); strongly acid; gradual smooth boundary.

Bt4—35 to 42 inches; light olive gray (5Y 6/2) silty clay loam (34 percent clay); olive gray (5Y 5/2) coatings on faces of peds; common fine distinct light olive brown (2.5Y 5/4) mottles; moderate medium prismatic structure parting to moderate medium subangular blocky; firm; few thin discontinuous dark gray (10YR 4/1) clay films on vertical faces of peds; common fine distinct strong brown (7.5YR 5/6) soft

accumulations (iron and manganese oxides); medium acid; gradual smooth boundary.

Bt5—42 to 51 inches; light olive gray (5Y 6/2) silty clay loam (32 percent clay); gray (5Y 5/1) coatings on faces of peds; common fine distinct yellowish brown (10YR 5/4) mottles; moderate coarse prismatic structure parting to moderate medium prismatic; firm; few thin discontinuous very dark gray (10YR 3/1) clay films on vertical faces of peds; common fine distinct strong brown (7.5YR 5/6) soft accumulations (iron and manganese oxides); slightly acid; gradual smooth boundary.

BC—51 to 60 inches; gray (5Y 5/1) silty clay loam (32 percent clay); common medium prominent strong brown (7.5YR 5/6) and many fine prominent yellowish brown (10YR 5/4) mottles; weak coarse prismatic structure; firm; few very thin discontinuous very dark gray (10YR 3/1) clay films on vertical faces of peds; neutral.

The solum ranges from 48 to 72 inches in thickness. The A horizon has hue of 10YR, value of 2 or 3, and chroma of 1 or 2. It ranges from 12 to 20 inches in thickness. Some pedons have a BA horizon. This horizon has hue of 10YR or 2.5Y, value of 3 or 4, and chroma of 2 and has mottles with chroma of 2 or less. The Bt1 and Bt2 horizons have a clay content of 34 to 42 percent. The Bt horizon has hue of 2.5Y or 10YR in the upper part and 2.5Y or 5Y in the lower part. It is very strongly acid to slightly acid. The depth to the horizon having the highest content of clay ranges from 18 to 30 inches.

Mystic Series

The Mystic series consists of somewhat poorly drained, slowly permeable soils on side slopes in the uplands. These soils formed in loamy and clayey alluvial and colluvial sediments derived from glacial till. The native vegetation was mixed prairie grasses and deciduous trees. Slopes range from 9 to 14 percent.

Typical pedon of Mystic loam, 9 to 14 percent slopes, moderately eroded, in an area of pasture; 2,100 feet north and 1,062 feet east of the southwest corner of sec. 10, T. 75 N., R. 8 W.

Ap—0 to 7 inches; very dark grayish brown (10YR 3/2) and very dark gray (10YR 3/1) loam, grayish brown (10YR 5/2) dry; mixed with some streaks and pockets of brown (7.5YR 4/4) clay subsoil material; weak fine granular structure; friable; strongly acid; abrupt smooth boundary.

Bt1—7 to 13 inches; brown (7.5YR 4/4) and dark yellowish brown (10YR 4/4) clay; common fine prominent red (2.5YR 4/6) and common fine distinct grayish brown (10YR 5/2) and strong brown (7.5YR 5/6) mottles; moderate fine subangular blocky structure; very firm; thin continuous dark brown (7.5YR 3/2) and dark yellowish brown (10YR 3/4) clay films on faces of peds; thin discontinuous light gray (10YR 7/2) dry silt coatings on faces of peds; few small dark concretions (iron and manganese oxides); about 3 percent small pebbles; very strongly acid; gradual smooth boundary.

Bt2—13 to 20 inches; grayish brown (2.5Y 5/2) and dark grayish brown (2.5Y 4/2) clay; common fine distinct strong brown (7.5YR 5/6) and few fine prominent red (2.5YR 4/6) and dusky red (2.5YR 3/2) mottles; moderate medium subangular blocky structure; very firm; thin nearly continuous brown (7.5YR 4/4) clay films on faces of peds; common small dark concretions (iron and manganese oxides); very strongly acid; gradual smooth boundary.

Bt3—20 to 27 inches; grayish brown (2.5Y 5/2) clay loam; common fine distinct yellowish brown (10YR 5/6) and strong brown (7.5YR 5/6) and few fine prominent red (2.5YR 4/6) mottles; weak medium prismatic structure parting to moderate medium subangular blocky; firm; thin discontinuous dark grayish brown (10YR 4/2) clay films on faces of peds and in root channels; common small dark concretions (iron and manganese oxides); very strongly acid; gradual smooth boundary.

Bt4—27 to 33 inches; grayish brown (2.5Y 5/2) clay loam; few fine prominent red (2.5YR 4/6), common coarse prominent strong brown (7.5YR 5/6), and common medium faint light brownish gray (2.5Y 6/2) mottles; weak coarse prismatic structure parting to weak medium subangular blocky; firm; few spherical red (2.5YR 4/6) clay accumulations; few red (2.5YR 4/6) clay flows in root channels; common medium dark concretions (iron and manganese oxides); very strongly acid; gradual smooth boundary.

Bt5—33 to 39 inches; grayish brown (2.5Y 5/2) sandy clay loam; common coarse prominent strong brown (7.5YR 5/6) and common medium faint light brownish gray (2.5Y 6/2) mottles; weak coarse and medium prismatic structure; friable; few thin discontinuous brown (7.5YR 4/2) clay films on faces of prisms; common medium dark reddish brown (5YR 3/2) and black (10YR 2/1) concretions (iron and manganese oxides); very strongly acid; gradual smooth boundary.

Bt6—39 to 46 inches; grayish brown (2.5Y 5/2) sandy clay loam; common coarse prominent strong brown (7.5YR 5/6) and common medium faint light brownish gray (2.5Y 6/2) mottles; weak coarse prismatic structure; friable; few thin discontinuous brown (7.5YR 4/2) clay films on faces of prisms; common medium dark reddish brown (5YR 3/2) and black (10YR 2/1) concretions (iron and manganese oxides); strongly acid; gradual smooth boundary.

BC—46 to 56 inches; grayish brown (2.5Y 5/2) clay loam; weak coarse prismatic structure; friable; brown (7.5YR 4/2) clay flows in root channels; few small

dark accumulations (iron and manganese oxides); strongly acid; gradual smooth boundary.

C—56 to 60 inches; mixed light brownish gray (2.5Y 6/2), strong brown (7.5YR 5/6), and yellowish brown (10YR 5/6) sandy clay loam; massive; friable; few small soft dark accumulations (iron and manganese oxides); strongly acid.

The solum ranges from 48 to 72 inches in thickness. It is medium acid to very strongly acid.

The A or Ap horizon is very dark gray (10YR 3/1) or very dark grayish brown (10YR 3/2). It is loam, clay loam, or silt loam. The Bt horizon is sandy clay loam, clay loam, silty clay, or clay. It generally has hue of 2.5YR to 2.5Y, value of 3 to 5, and chroma of 2 to 4. At least part of this horizon has hue of 7.5YR or redder in the matrix or in many distinct or prominent mottles. Moderately coarse textured or fine textured sediments high in content of quartz are common in the lower part of the Bt horizon.

Nevin Series

The Nevin series consists of somewhat poorly drained, moderately permeable soils on stream terraces or high second bottoms. These soils formed in alluvium. The native vegetation was mixed prairie grasses. Slopes range from 0 to 2 percent.

Typical pedon of Nevin silty clay loam, 0 to 2 percent slopes, in a cultivated field; 235 feet east and 1,200 feet south of the center of sec. 12, T. 77 N., R. 8 W.

Ap—0 to 8 inches; black (10YR 2/1) silty clay loam, dark gray (10YR 4/1) dry; weak fine granular structure; friable; slightly acid; abrupt smooth boundary.

A1—8 to 12 inches; black (10YR 2/1) silty clay loam, dark gray (10YR 4/1) dry; weak very fine subangular blocky structure parting to weak fine granular; friable; neutral; gradual smooth boundary.

A2—12 to 20 inches; black (10YR 2/1) silty clay loam, dark gray (10YR 4/1) dry; few fine faint dark grayish brown (10YR 4/2) mottles; weak fine subangular blocky structure parting to weak fine granular; friable; neutral; gradual smooth boundary.

BA—20 to 26 inches; dark grayish brown (10YR 4/2) and brown (10YR 5/3) silty clay loam; few very dark gray (10YR 3/1) and dark gray (10YR 4/1) coatings on faces of peds; common fine faint yellowish brown (10YR 5/6) mottles; weak fine subangular blocky structure parting to weak fine granular; friable; medium acid; gradual smooth boundary.

Bt1—26 to 32 inches; grayish brown (2.5Y 5/2) silty clay loam; common fine distinct strong brown (7.5YR 5/6 and 5/8) mottles; weak medium subangular blocky structure parting to weak very fine prismatic; friable; thin discontinuous dark grayish brown (10YR 4/2) clay films on faces of peds; medium acid; gradual smooth boundary.

Bt2—32 to 43 inches; grayish brown (2.5Y 5/2) silty clay loam; common fine distinct strong brown (7.5YR 5/6 and 5/8) mottles; moderate medium prismatic structure parting to weak medium subangular blocky; friable; thin nearly continuous dark gray (10YR 4/1) and very dark gray (10YR 3/1) clay films on faces of peds; medium acid; gradual smooth boundary.

Bt3—43 to 50 inches; grayish brown (2.5Y 5/2) silty clay loam; common fine distinct strong brown (7.5YR 5/6 and 5/8) mottles; moderate medium prismatic structure parting to weak medium subangular blocky; friable; thick nearly continuous dark grayish brown (10YR 4/2) clay films on faces of peds; few very dark gray (10YR 3/1) clay flows in root channels; medium acid; gradual smooth boundary.

BC—50 to 60 inches; grayish brown (2.5Y 5/2) silty clay loam; common fine distinct strong brown (7.5YR 5/8 and 5/6) mottles; weak medium prismatic structure; firm; thin nearly discontinuous dark grayish brown (2.5Y 4/2) clay films on faces of peds; common very dark gray (10YR 3/1) clay flows in root channels; few small dark accumulations (iron and manganese oxides); medium acid.

The solum ranges from 42 to 60 inches in thickness. The A horizon generally is black (10YR 2/1) or very dark gray (10YR 3/1), but in some pedons it is very dark grayish brown (10YR 3/2) in the lower part. It typically is silty clay loam but in some pedons is silt loam. The BA and Bt horizons have hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 2 to 4. They have mottles with higher chroma in most pedons. The Bt horizon is silty clay loam that has a clay content of 30 to 35 percent. It is medium acid or slightly acid.

Nira Series

The Nira series consists of moderately well drained, moderately permeable soils on upland side slopes and in coves at the head of drainageways. These soils formed in deoxidized loess. The native vegetation was mixed prairie grasses. Slopes range from 2 to 9 percent.

Typical pedon of Nira silty clay loam, 2 to 5 percent slopes, in a cultivated field; 1,880 feet north and 140 feet east of the center of sec. 8, T. 74 N., R. 6 W.

Ap—0 to 7 inches; very dark gray (10YR 3/1) silty clay loam (33 percent clay), dark gray (10YR 4/1) dry; many black (10YR 2/1) coatings on faces of peds; weak fine granular structure; friable; slightly acid; abrupt smooth boundary.

A—7 to 12 inches; very dark grayish brown (10YR 3/2) silty clay loam (34 percent clay), dark grayish brown (10YR 4/2) dry; common very dark gray (10YR 3/1) coatings on faces of peds throughout the horizon and few brown (10YR 4/3) coatings on faces of peds in the lower part; weak fine subangular blocky

structure parting to weak fine granular; friable; medium acid; gradual smooth boundary.

Bw1—12 to 19 inches; brown (10YR 4/3) silty clay loam (35 percent clay); very dark gray (10YR 3/1) coatings on faces of about 20 percent of the peds; few fine distinct grayish brown (2.5Y 5/2) and light brownish gray (2.5Y 6/2) mottles; weak fine subangular blocky structure; friable; strongly acid; gradual smooth boundary.

Bw2—19 to 28 inches; light brownish gray (2.5Y 6/2) and grayish brown (2.5Y 5/2) silty clay loam (34 percent clay); common fine prominent strong brown (7.5YR 5/6 and 5/8) mottles; moderate fine subangular blocky structure; friable; few thin patchy dark gray (10YR 4/1) clay films in root channels; few small dark accumulations (iron and manganese oxides); medium acid; gradual smooth boundary.

Bw3—28 to 35 inches; light brownish gray (2.5Y 6/2) and grayish brown (2.5Y 5/2) silty clay loam (33 percent clay); common fine prominent strong brown (7.5YR 5/6 and 5/8) and few fine prominent strong brown (7.5YR 4/6) mottles; weak fine prismatic structure parting to moderate medium subangular blocky; friable; few thin patchy discontinuous brown (10YR 5/3) and dark gray (10YR 4/1) clay films in root channels; few small dark accumulations (iron and manganese oxides); medium acid; gradual smooth boundary.

BC—35 to 43 inches; light brownish gray (2.5Y 6/2) and grayish brown (2.5Y 5/2) silty clay loam (32 percent clay); many medium prominent strong brown (7.5YR 5/6 and 5/8) and few fine prominent strong brown (7.5YR 4/6) mottles; weak medium prismatic structure parting to weak medium subangular blocky; friable; few dark gray (10YR 4/1) clay flows in root channels; common small dark accumulations (iron and manganese oxides); medium acid; gradual smooth boundary.

C—43 to 60 inches; light brownish gray (2.5Y 6/2) silt loam (26 percent clay); common medium prominent yellowish brown (10YR 5/6) and few medium prominent yellowish red (5YR 5/8) mottles; massive with vertical cleavage; friable; few thick clay flows in root channels; medium acid.

The solum ranges from 30 to 50 inches in thickness. The A horizon is black (10YR 2/1), very dark gray (10YR 3/1), or very dark grayish brown (10YR 3/2). It is 10 to 15 inches thick. The upper 6 inches or more of the Bw horizon is brown (10YR 4/3) or dark yellowish brown (10YR 4/4) and has mottles with value of 4 to 6 and chroma of 2. The maximum content of clay in the solum typically is 33 to 38 percent. It is in a BA horizon or the upper part of the Bw horizon. The Bw horizon has hue of 2.5Y or 5Y, value of 5 or 6, and chroma of 1 or 2 within a depth of 30 inches. It is medium acid or strongly acid.

Nira silty clay loam, 5 to 9 percent slopes, severely eroded, is a taxadjunct to the Nira series because it does not have a mollic epipedon.

Nodaway Series

The Nodaway series consists of moderately well drained, moderately permeable soils on flood plains along the major streams and in upland drainageways. These soils formed in recently deposited alluvium. Slopes range from 0 to 5 percent.

Typical pedon of Nodaway silt loam, 0 to 2 percent slopes, in an area of permanent pasture; 1,820 feet east and 30 feet south of the northwest corner of sec. 33, T. 77 N., R. 7 W.

A—0 to 8 inches; very dark grayish brown (10YR 3/2) silt loam, grayish brown (10YR 5/2) dry; weak fine granular structure; friable; thin strata of grayish brown (10YR 5/2) silt loam; neutral; clear smooth boundary.

C—8 to 60 inches; stratified very dark gray (10YR 3/1), dark grayish brown (10YR 4/2), and grayish brown (10YR 5/2) silt loam; appears massive but has weak bedding planes; friable; few thin strata of very dark grayish brown (10YR 3/2) and light brownish gray (10YR 6/2) silt loam; few dark yellowish brown (10YR 4/4) iron oxide stains in root channels; slightly acid.

The A horizon is very dark gray (10YR 3/1) or very dark grayish brown (10YR 3/2). It is 6 to 10 inches thick and is slightly acid or neutral. The C horizon is stratified dark grayish brown (10YR 4/2), dark brown (10YR 3/3), brown (10YR 4/3), grayish brown (10YR 5/2), very dark grayish brown (10YR 3/2), or very dark gray (10YR 3/1). It typically is silt loam but in some pedons is silty clay loam. It has a clay content of 18 to 28 percent. The average sand content in the 10- to 40-inch control section is less than 15 percent. Some pedons are sandy below a depth of 40 inches. Reaction is neutral or slightly acid throughout the profile.

Nordness Series

The Nordness series consists of shallow, well drained, moderately permeable soils on upland side slopes. These soils formed in silty or loamy material over limestone bedrock. The native vegetation was deciduous trees. Slopes range from 14 to 25 percent.

Typical pedon of Nordness silt loam, 14 to 25 percent slopes, in an area of permanent pasture; 1,660 feet north and 10 feet east of the center of sec. 13, T. 74 N., R. 9 W.

A—0 to 4 inches; dark grayish brown (10YR 4/2) silt loam, light brownish gray (10YR 6/2) dry; weak thin platy structure parting to weak fine subangular

blocky; friable; common light gray (10YR 7/2) dry silt coatings on faces of peds; slightly acid; clear smooth boundary.

E—4 to 8 inches; dark grayish brown (10YR 4/2) silt loam, light brownish gray (10YR 6/2) dry; mixed with a small amount of brown (10YR 4/3) material; weak thin platy structure; friable; common light gray (10YR 7/2) dry silt coatings on faces of peds; slightly acid; clear smooth boundary.

Bt1—8 to 13 inches; brown (10YR 4/3) and dark grayish brown (10YR 4/2) silty clay loam; weak fine subangular blocky structure; friable; thin discontinuous brown (7.5YR 4/4) clay films on faces of peds; common light gray (10YR 7/2) dry silt coatings on faces of peds; slightly acid; clear smooth boundary.

2Bt2—13 to 17 inches; reddish brown (5YR 4/4) clay; moderate fine subangular blocky structure; firm; thin discontinuous reddish brown (5YR 4/3) clay films on faces of peds; few light gray (10YR 7/2) dry silt coatings on faces of peds; few small chert fragments; medium acid; abrupt wavy boundary.

2R—17 inches; hard fractured limestone bedrock.

The solum ranges from 8 to 20 inches in thickness. It is neutral to medium acid.

The A horizon has hue of 10YR, value of 2 to 4, and chroma of 1 or 2. It is silt loam or loam. The 2Bt horizon has hue of 5YR or 7.5YR, value of 3 or 4, and chroma of 2 to 4. It is clay, silty clay, or silty clay loam.

Okaw Series

The Okaw series consists of very poorly drained, very slowly permeable soils on stream terraces. These soils formed in silty alluvium. The native vegetation was deciduous trees. Slopes range from 0 to 2 percent.

Typical pedon of Okaw silt loam, 0 to 2 percent slopes, in a cultivated field; 140 feet south and 160 feet west of the northeast corner of sec. 1, T. 76 N., R. 6 W.

Ap—0 to 7 inches; dark grayish brown (10YR 4/2) silt loam, light brownish gray (10YR 6/2) dry; weak fine granular structure; friable; few small dark brown (7.5YR 3/2) concretions (iron and manganese oxides); neutral; abrupt smooth boundary.

E1—7 to 12 inches; light brownish gray (10YR 6/2) silt loam, light gray (10YR 7/2) dry; few fine distinct dark yellowish brown (10YR 4/4) mottles; moderate medium platy structure; friable; few small dark brown (7.5YR 3/2) concretions (iron and manganese oxides); medium acid; clear smooth boundary.

E2—12 to 16 inches; light brownish gray (10YR 6/2) silt loam, light gray (10YR 7/2) dry; common fine distinct dark yellowish brown (10YR 4/4) mottles; weak medium platy structure parting to weak fine subangular blocky; friable; very few small dark brown (7.5YR 3/2) accumulations (iron and manganese oxides); medium acid; clear wavy boundary.

Btg1—16 to 23 inches; grayish brown (10YR 5/2) silty clay; few fine distinct strong brown (7.5YR 5/6) and brown (7.5YR 4/4) mottles; moderate medium angular blocky structure; firm; thin discontinuous dark grayish brown (10YR 4/2) clay films on faces of peds; thin discontinuous light gray (10YR 7/2) dry silt coatings on faces of peds; very strongly acid; gradual smooth boundary.

Btg2—23 to 29 inches; grayish brown (2.5Y 5/2) silty clay; few fine distinct yellowish brown (10YR 5/6) and brown (7.5YR 4/4) mottles; weak medium prismatic structure parting to moderate medium subangular blocky; firm; thin discontinuous grayish brown (10YR 5/2) clay films on faces of peds; very few thin discontinuous light gray (10YR 7/2) dry silt coatings on faces of peds; very strongly acid; gradual smooth boundary.

Btg3—29 to 37 inches; light brownish gray (2.5Y 6/2) silty clay; common fine prominent yellowish brown (10YR 5/6) and few coarse prominent reddish brown (5YR 4/4) mottles; moderate medium prismatic structure; firm; thin discontinuous grayish brown (2.5Y 5/2) clay films on faces of peds; very few thin light gray (10YR 7/2) dry silt coatings on faces of peds; few small dark brown (7.5YR 3/2) concretions (iron and manganese oxides); strongly acid; gradual smooth boundary.

BCg—37 to 45 inches; light brownish gray (2.5Y 6/2) silty clay loam; few fine prominent yellowish brown (10YR 5/6) and few medium prominent reddish brown (5YR 4/4) mottles; weak medium prismatic structure; firm; very few thin discontinuous grayish brown (2.5Y 5/2) clay films on faces of peds; common small dark brown (7.5YR 3/2) concretions (iron and manganese oxides); strongly acid; gradual smooth boundary.

Cg—45 to 60 inches; light brownish gray (2.5Y 6/2) silty clay loam; common fine distinct yellowish brown (10YR 5/6) and few medium prominent yellowish red (5YR 4/6) mottles; massive; firm; common small dark brown (7.5YR 3/2) concretions (iron and manganese oxides); strongly acid.

The solum ranges from 35 to 55 inches in thickness. The A or Ap horizon has hue of 10YR, value of 4 to 6, and chroma of 2. The E horizon has hue of 10YR, value of 5 to 7, and chroma of 1 or 2. It has a clay content of 15 to 20 percent. The Btg horizon has hue of 10YR, 2.5Y, or 5Y, value of 4 to 6, and chroma of 2 or less. It is silty clay loam, silty clay, or clay. It is medium acid to extremely acid. The upper 20 inches of the argillic horizon has a clay content of 35 to 48 percent. The Cg horizon typically is silty clay loam but in some pedons is silty clay.

Otley Series

The Otley series consists of deep, moderately well drained, moderately permeable soils on convex ridgetops and the upper side slopes in the uplands and on high stream benches. These soils formed in loess. The native vegetation was mixed prairie grasses. Slopes range from 2 to 14 percent.

Typical pedon of Otley silty clay loam, 2 to 5 percent slopes, in a cultivated field; 2,077 feet east and 226 feet south of the northwest corner of sec. 27, T. 76 N., R. 8 W.

Ap—0 to 8 inches; very dark brown (10YR 2/2) silty clay loam, dark gray (10YR 4/1) dry; black (10YR 2/1) coatings on faces of peds; weak fine granular structure; friable; medium acid; abrupt smooth boundary.

A—8 to 12 inches; black (10YR 2/1) silty clay loam, dark grayish brown (10YR 4/2) dry; weak fine granular structure; friable; slightly acid; clear smooth boundary.

AB—12 to 18 inches; very dark grayish brown (10YR 3/2) silty clay loam, grayish brown (10YR 5/2) dry; mixed with some brown (10YR 4/3) material; weak fine subangular blocky structure parting to weak fine granular; friable; slightly acid; clear smooth boundary.

Bt1—18 to 25 inches; brown (10YR 4/3) silty clay loam; few fine faint yellowish brown (10YR 5/6) mottles; weak medium and fine subangular blocky structure; firm; few thin discontinuous dark brown (10YR 3/3) clay films on faces of peds; medium acid; gradual smooth boundary.

Bt2—25 to 33 inches; brown (10YR 4/3) silty clay loam; few fine distinct strong brown (7.5YR 5/6) and grayish brown (2.5Y 5/2) mottles; moderate medium and fine subangular blocky structure; firm; few thin discontinuous dark brown (10YR 3/3) clay films on faces of peds; medium acid; gradual smooth boundary.

Bt3—33 to 39 inches; brown (10YR 5/3) silty clay loam; few fine distinct dark brown (7.5YR 4/4), strong brown (7.5YR 5/6), and grayish brown (2.5Y 5/2) mottles; weak medium prismatic structure parting to weak medium subangular blocky; firm; few brown (10YR 4/3) clay films on vertical faces of peds; few small dark accumulations (iron and manganese oxides); medium acid; gradual smooth boundary.

Bt4—39 to 45 inches; brown (10YR 5/3) silty clay loam; common fine prominent dark reddish brown (5YR 3/3) and common fine distinct strong brown (7.5YR 5/6 and 5/8) and light brownish gray (10YR 6/2) mottles; weak medium prismatic structure; firm; thin discontinuous clay films on faces of prisms; few small dark accumulations (iron and manganese oxides); medium acid; gradual smooth boundary.

BC—45 to 60 inches; mixed light brownish gray (2.5Y 6/2), strong brown (7.5YR 5/6), and yellowish brown (10YR 5/6 and 5/8) silty clay loam; weak coarse prismatic structure; firm; few small dark accumulations (iron and manganese oxides); neutral.

The solum ranges from 48 to 72 inches in thickness. The A horizon is black (10YR 2/1) or very dark brown (10YR 2/2). It is silty clay loam that has a clay content of 28 to 34 percent. The Bt horizon is brown (10YR 4/3 or 5/3) or yellowish brown (10YR 5/4). In some pedons a few mottles with chroma of 2 are as shallow as 20 inches. Reaction is medium acid or strongly acid in the Bt horizon. The BC horizon has hue of 2.5Y, 10YR, or 7.5YR, value of 5 or 6, and chroma of 2 to 8. It is silty clay loam or silt loam.

Otley silty clay loam, 5 to 9 percent slopes, severely eroded, and Otley silty clay loam, 9 to 14 percent slopes, severely eroded, are taxadjuncts to the Otley series because they do not have a mollic epipedon.

Perks Series

The Perks series consists of deep, excessively drained, rapidly permeable soils on flood plains. These soils formed in sandy alluvium. The native vegetation was mixed prairie grasses and deciduous trees. Slopes range from 0 to 3 percent.

Typical pedon of Perks sandy loam, 0 to 3 percent slopes, in a cultivated field; 2,280 feet south and 300 feet east of the northwest corner of sec. 32, T. 75 N., R. 7 W.

Ap—0 to 8 inches; very dark grayish brown (10YR 3/2) and dark brown (10YR 3/3) sandy loam, grayish brown (10YR 5/2) dry; weak fine granular structure; very friable; slightly acid; abrupt smooth boundary.

C1—8 to 29 inches; brown (10YR 4/3 and 5/3) stratified sand and loamy sand; few very dark grayish brown (10YR 3/2) organic coatings on sand grains; single grained; loose; medium acid; gradual wavy boundary.

C2—29 to 60 inches; brown (10YR 4/3) stratified loamy sand, sand, and sandy loam; few very dark grayish brown (10YR 3/2) organic coatings on sand grains; few fine faint brown (10YR 5/3) mottles; single grained; loose; thin grayish brown (10YR 5/2) strata at a depth of 42 inches; slightly acid.

The thickness of the solum corresponds to the thickness of the A or Ap horizon, which is less than 10 inches. The Ap horizon is dark brown (10YR 3/3), very dark grayish brown (10YR 3/2), dark grayish brown (10YR 4/2), or brown (10YR 4/3). It is sandy loam or loamy sand. The C horizon has hue of 10YR, value of 4 or 5, and chroma of 3 to 6. Some very dark grayish brown (10YR 3/2) or dark brown (10YR 3/3) strata are

below a depth of 29 inches in some pedons. The A and C horizons are slightly acid or medium acid.

Rinda Series

The Rinda series consists of poorly drained, very slowly permeable soils on short, convex side slopes, on convex nose slopes, and in coves at the upper end of drainageways in the uplands. These soils formed in a thin mantle of loess and a gray, clayey paleosol that formed in glacial till. The native vegetation was mixed prairie grasses and deciduous trees. Slopes range from 5 to 14 percent.

Typical pedon of Rinda silty clay loam, 9 to 14 percent slopes, moderately eroded, in a cultivated field; 430 feet south and 100 feet west of the northeast corner of sec. 24, T. 75 N., R. 9 W.

Ap—0 to 7 inches; very dark gray (10YR 3/1) silty clay loam, dark gray (10YR 4/1) dry; mixed with streaks and pockets of dark grayish brown (10YR 4/2) subsoil material; weak fine granular structure; friable; neutral; abrupt smooth boundary.

BE—7 to 9 inches; dark grayish brown (10YR 4/2) silty clay loam, grayish brown (10YR 5/2) dry; few very dark grayish brown (10YR 3/2) and very dark gray (10YR 3/1) coatings on faces of peds; moderate fine granular structure; friable; slightly acid; clear smooth boundary.

2Btg1—9 to 16 inches; grayish brown (10YR 5/2) silty clay; common fine faint brown (10YR 5/3) mottles; weak fine subangular blocky structure; firm; thin discontinuous clay films on faces of peds; medium acid; gradual smooth boundary.

2Btg2—16 to 31 inches; dark gray (10YR 4/1) silty clay; strong fine angular blocky structure; very firm; thin continuous clay films on faces of peds; medium acid; gradual smooth boundary.

2Btg3—31 to 47 inches; grayish brown (10YR 5/2) silty clay; moderate medium subangular blocky structure; very firm; continuous dark gray (10YR 4/1) clay coatings on faces of peds; coarse sand in the lower 3 inches; slightly acid; gradual smooth boundary.

2Btg4—47 to 55 inches; grayish brown (2.5Y 5/2) silty clay; few fine prominent strong brown (7.5YR 5/8) and reddish brown (5YR 5/4) mottles; moderate medium subangular blocky structure; firm; few thin discontinuous gray (10YR 5/1) clay films on faces of peds; neutral; gradual smooth boundary.

2Btg5—55 to 60 inches; light brownish gray (2.5Y 6/2) silty clay; moderate fine prismatic structure parting to weak fine angular blocky; firm; thin discontinuous grayish brown (2.5Y 5/2) clay films on vertical faces of peds; few coarse sand grains; neutral.

The solum ranges from 42 to more than 60 inches in thickness. It is neutral to strongly acid.

The A or Ap horizon is very dark gray (10YR 3/1) or very dark grayish brown (10YR 3/2). Some pedons have an E horizon. This horizon is dark grayish brown (10YR 4/2) or grayish brown (10YR 5/2). The Ap and E horizons are neutral to medium acid. The BE horizon has hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 2. The 2Btg horizon has hue of 10YR, 2.5Y, or 5Y, value of 4 to 6, and chroma of 1 or 2. It has a clay content of 45 to 55 percent in the upper 30 inches. The content and size of sand particles increase with increasing depth.

Rubio Series

The Rubio series consists of poorly drained, very slowly permeable soils in slight depressions or on broad upland divides. These soils formed in loess. The native vegetation was sedges, prairie grasses, and deciduous trees that can tolerate wetness. Slopes range from 0 to 2 percent.

Typical pedon of Rubio silt loam, 0 to 2 percent slopes, in a meadow; 1,400 feet east and 650 feet north of the southwest corner of sec. 14, T. 74 N., R. 9 W.

Ap—0 to 8 inches; very dark gray (10YR 3/1) silt loam (23 percent clay), dark gray (10YR 4/1) dry; weak fine granular structure; friable; slightly acid; abrupt smooth boundary.

E1—8 to 12 inches; gray (10YR 5/1) and dark gray (10YR 4/1) silt loam (21 percent clay), light gray (10YR 7/1) dry; few fine distinct dark brown (7.5YR 4/4) and strong brown (7.5YR 5/6) mottles; moderate medium platy structure; friable; medium acid; clear smooth boundary.

E2—12 to 16 inches; gray (10YR 5/1) and dark gray (10YR 4/1) silt loam (21 percent clay), light gray (10YR 7/1) dry; few fine distinct dark brown (7.5YR 4/4) and strong brown (7.5YR 5/8) mottles; moderate medium platy structure parting to weak fine subangular blocky; friable; medium acid; clear smooth boundary.

Btg1—16 to 26 inches; olive gray (5Y 5/2) silty clay (45 percent clay); common fine prominent strong brown (7.5YR 5/8) and few fine prominent strong brown (7.5YR 4/8) mottles; moderate medium prismatic structure parting to moderate medium subangular blocky; firm; thick nearly continuous dark gray (10YR 4/1) clay films on faces of peds; few light gray (10YR 7/1) dry silt coatings on faces of peds; few soft dark accumulations (iron and manganese oxides); strongly acid; gradual smooth boundary.

Btg2—26 to 40 inches; olive gray (5Y 5/2) silty clay (40 percent clay); many fine prominent strong brown (7.5YR 5/8) and few fine prominent strong brown (7.5YR 4/6) mottles; moderate medium prismatic structure parting to weak coarse subangular blocky; firm; thick discontinuous dark gray (10YR 4/1) clay films on faces of peds; few soft dark accumulations

(iron and manganese oxides); strongly acid; gradual smooth boundary.

Btg3—40 to 54 inches; light olive gray (5Y 6/2) silty clay loam (36 percent clay); many medium prominent strong brown (7.5YR 5/8 and 4/6) mottles; weak medium prismatic structure; firm; thick discontinuous dark gray (10YR 4/1) clay films on faces of peds; few dark concretions (iron and manganese oxides); strongly acid; gradual smooth boundary.

Cg—54 to 60 inches; light olive gray (5Y 6/2) silty clay loam (32 percent clay); many medium prominent strong brown (7.5YR 5/8 and 4/6) mottles; massive; friable; few dark concretions (iron and manganese oxides); medium acid.

The solum ranges from 36 to 72 inches in thickness. The A or Ap horizon is very dark gray (10YR 3/1) or very dark grayish brown (10YR 3/2). The E horizon has hue of 10YR, value of 4 or 5, and chroma of 1 or 2. The Btg horizon ranges from 18 to 40 inches in thickness. It is olive gray (5Y 5/2), light olive gray (5Y 6/2), or gray (5Y 5/1). It is medium acid or strongly acid. The content of clay increases abruptly between the E and Btg horizons.

Shelby Series

The Shelby series consists of well drained, moderately slowly permeable soils on convex side slopes in the uplands. These soils formed in glacial till. The native vegetation was mixed prairie grasses. Slopes range from 9 to 14 percent.

Typical pedon of Shelby loam, 9 to 14 percent slopes, moderately eroded, in a cultivated field; 1,490 feet west and 120 feet south of the northeast corner of sec. 23, T. 76 N., R. 7 W.

Ap—0 to 10 inches; black (10YR 2/1) loam, dark gray (10YR 4/1) dry; mixed with streaks and pockets of dark yellowish brown (10YR 4/4) clay loam subsoil material; weak fine granular structure; friable; strongly acid; clear smooth boundary.

Bt1—10 to 18 inches; dark yellowish brown (10YR 4/4) clay loam; common very dark grayish brown (10YR 3/2) coatings on faces of peds; weak fine subangular blocky structure; friable; thin nearly continuous clay films on faces of peds; few small pebbles; strongly acid; clear smooth boundary.

Bt2—18 to 24 inches; yellowish brown (10YR 5/4) clay loam; weak fine and medium subangular blocky structure; firm; thin nearly continuous clay films on faces of peds; few small pebbles; strongly acid; gradual smooth boundary.

Bt3—24 to 29 inches; yellowish brown (10YR 5/6) clay loam; weak medium angular blocky structure parting to moderate fine subangular blocky; firm; thin discontinuous clay films on faces of peds; few small pebbles; strongly acid; clear smooth boundary.

Bt4—29 to 39 inches; yellowish brown (10YR 5/6) clay loam; moderate medium angular blocky structure; firm; thin discontinuous clay films on faces of peds; few small pebbles; medium acid; clear smooth boundary.

Bt5—39 to 51 inches; brown (10YR 5/3) and yellowish brown (10YR 5/6) clay loam; weak medium prismatic structure; firm; very thin discontinuous clay films on faces of peds; few small pebbles; medium acid; clear smooth boundary.

BC—51 to 55 inches; mixed yellowish brown (10YR 5/6 and 5/4), light brownish gray (10YR 6/2), and strong brown (7.5YR 5/6) clay loam; moderate coarse prismatic structure; firm; few small pebbles; slightly acid; gradual smooth boundary.

C—55 to 60 inches; mixed yellowish brown (10YR 5/6 and 5/8) and light brownish gray (10YR 6/2) clay loam; massive with some vertical cleavage; firm; few small pebbles; neutral.

The solum ranges from 30 to 75 inches in thickness. It is slightly acid to strongly acid. The C horizon is slightly acid to moderately alkaline.

The Ap horizon is black (10YR 2/1), very dark grayish brown (10YR 3/2), or very dark gray (10YR 3/1). It is loam or clay loam. The Bt horizon is 20 to 57 inches thick. It has a clay content of 32 to 35 percent. The upper part of this horizon has hue of 10YR and value and chroma of 3 or 4. The lower part has hue of 10YR, value of 4 or 5, and chroma of 3 to 6.

The Shelby soil in the map unit Shelby-Adair clay loams, 9 to 14 percent slopes, severely eroded, is a taxadjunct to the Shelby series because it does not have a mollic epipedon.

Sparta Series

The Sparta series consists of excessively drained soils on stream terraces. These soils formed in sandy alluvium and eolian sand. The native vegetation was mixed prairie grasses. Permeability is moderately rapid in the upper part of the profile and rapid in the lower part. Slopes range from 2 to 9 percent.

Typical pedon of Sparta loamy fine sand, 2 to 9 percent slopes, in a cultivated field; 460 feet north and 1,610 feet west of the center of sec. 23, T. 77 N., R. 7 W.

Ap—0 to 8 inches; very dark grayish brown (10YR 3/2) loamy fine sand, grayish brown (10YR 5/2) dry; weak medium subangular blocky structure; very friable; medium acid; abrupt smooth boundary.

A—8 to 15 inches; very dark grayish brown (10YR 3/2) loamy fine sand, grayish brown (10YR 5/2) dry; weak coarse subangular blocky structure; very friable; medium acid; gradual smooth boundary.

AB—15 to 23 inches; very dark grayish brown (10YR 3/2) and dark brown (10YR 3/3) loamy fine sand; weak coarse subangular blocky structure; very friable; strongly acid; gradual smooth boundary.
Bw—23 to 38 inches; yellowish brown (10YR 5/6 and 5/4) fine sand; weak coarse subangular blocky structure; very friable; strongly acid; gradual smooth boundary.
C—38 to 60 inches; brownish yellow (10YR 6/6) fine sand; single grained; loose; strong brown (7.5YR 5/6) iron and clay bands, less than 1 inch thick, at depths of 42, 46, and 54 inches; strongly acid.

The solum ranges from 20 to 44 inches in thickness. The A horizon has hue of 10YR or 7.5YR, value of 2 or 3, and chroma of 1 or 2. It is loamy fine sand or loamy sand. The thickness of the Ap horizon combined with that of the A and AB horizons is as much as 24 inches. The Bw horizon has hue of 10YR or 7.5YR and value and chroma of 3 to 6. It is loamy fine sand, loamy sand, fine sand, or sand. The C horizon is sand or fine sand. The Bw and C horizons are medium acid or strongly acid.

Sperry Series

The Sperry series consists of very poorly drained, slowly permeable soils in slight depressions on uplands. These soils formed in loess. The native vegetation was sedges and prairie grasses that can tolerate wetness. Slopes range from 0 to 2 percent.

These soils are taxadjuncts to the Sperry series because they do not have an albic horizon and are not characterized by an abrupt textural change.

Typical pedon of Sperry silt loam, 0 to 2 percent slopes, in a cultivated field; 2,000 feet east and 26 feet south of the northwest corner of sec. 19, T. 75 N., R. 8 W.

Ap—0 to 9 inches; very dark gray (10YR 3/1) silt loam (26 percent clay), dark gray (10YR 4/1) dry; weak fine granular structure; friable; neutral; abrupt smooth boundary.
BE—9 to 13 inches; dark gray (10YR 4/1) and very dark gray (10YR 3/1) silty clay loam (31 percent clay), gray (10YR 5/1) dry; few fine faint dark yellowish brown (10YR 4/4) mottles; weak medium platy structure parting to weak fine granular; friable; light gray (10YR 6/1) dry silt coatings on faces of peds; neutral; clear smooth boundary.
Btg1—13 to 18 inches; very dark gray (10YR 3/1) and dark gray (10YR 4/1) silty clay loam (32 percent clay); few fine faint dark yellowish brown (10YR 4/4) and yellowish brown (10YR 5/6) mottles; weak fine subangular blocky structure parting to very weak fine angular blocky; friable; very dark gray (10YR 3/1) clay films on faces of peds; few dark concretions (iron and manganese oxides); slightly acid; clear smooth boundary.
Btg2—18 to 26 inches; very dark gray (10YR 3/1), dark gray (10YR 4/1), and grayish brown (2.5Y 5/2) silty clay (45 percent clay); common fine distinct strong brown (7.5YR 5/8) mottles; moderate medium subangular blocky structure parting to moderate fine angular blocky; firm; thick nearly continuous very dark gray (10YR 3/1) and dark gray (10YR 4/1) clay films on faces of peds; few dark concretions (iron and manganese oxides); slightly acid; gradual smooth boundary.
Btg3—26 to 33 inches; grayish brown (2.5Y 5/2) silty clay (43 percent clay); common fine distinct strong brown (7.5YR 5/8 and 5/6) mottles; moderate fine subangular blocky structure; firm; thick discontinuous very dark gray (10YR 3/1) and dark gray (10YR 4/1) clay films on faces of peds; few dark concretions (iron and manganese oxides); slightly acid; gradual smooth boundary.
Btg4—33 to 44 inches; grayish brown (2.5Y 5/2) silty clay loam (38 percent clay); common fine distinct strong brown (7.5YR 5/8 and 5/6) mottles; moderate fine prismatic structure; friable; discontinuous dark gray (10YR 4/1) clay films on vertical faces of peds; very dark gray (10YR 3/1) clay flows in root channels; few dark concretions (iron and manganese oxides); slightly acid; gradual smooth boundary.
BCg—44 to 55 inches; light brownish gray (2.5Y 6/2) and grayish brown (2.5Y 5/2) silty clay loam (34 percent clay); few fine distinct strong brown (7.5YR 5/8 and 5/6) mottles; weak medium prismatic structure; friable; few very dark gray (10YR 3/1) clay flows in root channels; few dark concretions (iron and manganese oxides); slightly acid; gradual smooth boundary.
Cg—55 to 60 inches; light brownish gray (2.5Y 6/2) and grayish brown (2.5Y 5/2) silty clay loam (32 percent clay); many fine distinct strong brown (7.5YR 5/6 and 5/8) mottles; massive; friable; slightly acid.

The solum ranges from 48 to 68 inches in thickness. It is neutral to strongly acid.

The Ap horizon is silt loam or silty clay loam. It is very dark gray (10YR 3/1) or black (10YR 2/1). The BE horizon has hue of 10YR or 2.5Y, value of 3 to 6, and chroma of 1 or 2. It is 2 to 6 inches thick. It has a clay content of 27 to 34 percent. The light gray silt coatings in this horizon are prominent when the peds are dry. The Btg horizon has hue of 10YR to 5Y, value of 3 to 5, and chroma of 1 or 2. It has clay films with hue of 10YR, value of 3 or 4, and chroma of 1 on the faces of peds. It generally has a clay content of 32 to 45 percent. Some subhorizons that are less than 6 inches thick, however, have a clay content of as much as 48 percent.

Taintor Series

The Taintor series consists of poorly drained, moderately slowly permeable soils on flats on broad upland divides. These soils formed in loess. The native vegetation was sedges and prairie grasses that can tolerate wetness. Slopes range from 0 to 2 percent.

Typical pedon of Taintor silty clay loam, 0 to 2 percent slopes, in a cultivated field; 900 feet east and 100 feet south of the center of sec. 7, T. 76 N., R. 7 W.

Ap—0 to 8 inches; black (10YR 2/1) silty clay loam (31 percent clay), dark gray (N 4/0) dry; black (N 2/0) coatings on faces of peds; weak fine granular structure; friable; medium acid; abrupt smooth boundary.

A—8 to 17 inches; black (N 2/0) silty clay loam (34 percent clay), dark gray (N 4/0) dry; moderate fine granular structure; friable; medium acid; gradual smooth boundary.

AB—17 to 22 inches; very dark gray (10YR 3/1) silty clay loam (39 percent clay), dark gray (10YR 4/1) dry; few fine distinct very dark grayish brown (2.5Y 3/2) mottles; moderate very fine subangular blocky structure; firm; medium acid; clear smooth boundary.

Btg1—22 to 27 inches; grayish brown (2.5Y 5/2) silty clay (42 percent clay); few dark gray (10YR 4/1) coatings on faces of peds; few fine distinct strong brown (7.5YR 5/6), yellowish brown (10YR 5/6), and dark gray (5Y 4/1) mottles; strong fine subangular blocky structure; firm; thick continuous very dark gray (10YR 3/1) clay films on faces of peds; medium acid; clear smooth boundary.

Btg2—27 to 34 inches; grayish brown (2.5Y 5/2) and olive gray (5Y 5/2) silty clay loam (39 percent clay); common fine distinct strong brown (7.5YR 5/8) and yellowish brown (10YR 5/6) mottles; moderate medium subangular and angular blocky structure; firm; thick nearly continuous very dark gray (10YR 3/1) clay films on faces of peds; medium acid; clear smooth boundary.

Btg3—34 to 40 inches; olive gray (5Y 5/2) silty clay loam (37 percent clay); common fine distinct strong brown (7.5YR 5/8) and few fine faint yellowish brown (10YR 5/6) mottles; weak medium prismatic structure parting to weak fine subangular blocky; firm; thick discontinuous very dark gray (10YR 3/1) clay films on faces of peds; medium acid; clear smooth boundary.

BCg—40 to 49 inches; olive gray (5Y 5/2) and light olive gray (5Y 6/2) silty clay loam (34 percent clay); moderate medium prismatic structure; friable; very thin discontinuous very dark gray (10YR 3/1) clay films on faces of peds; many yellowish red (5YR 5/8) concretions (iron and manganese oxides) in the upper part; common small black (10YR 2/1) concretions; slightly acid; gradual smooth boundary.

Cg—49 to 60 inches; olive gray (5Y 5/2) and light olive gray (5Y 6/2) silty clay loam (27 percent clay); common fine distinct strong brown (7.5YR 5/8) mottles; massive; few small black (10YR 2/1) concretions (iron and manganese oxides); friable; neutral.

The solum ranges from 42 to 72 inches in thickness. It is slightly acid or medium acid. The mollic epipedon is 16 to 24 inches thick.

The A horizon has hue of 10YR or is neutral in hue. It has value of 2 or 3 and chroma of 0 or 1. The Btg, BCg, and Cg horizons have hue of 10YR, 2.5Y, or 5Y, value of 4 to 6, and chroma of 1 or 2. The Btg horizon has a clay content of 38 to 42 percent.

Tuskeego Series

The Tuskeego series consists of poorly drained, very slowly permeable soils in nearly level and slightly depressional areas on low stream terraces or high second bottoms. These soils formed in alluvium. The native vegetation was sedges, mixed prairie grasses, and deciduous trees. Slopes range from 0 to 2 percent.

Typical pedon of Tuskeego silt loam, 0 to 2 percent slopes, in a cultivated field; 690 feet south and 1,420 feet west of the center of sec. 12, T. 77 N., R. 8 W.

Ap—0 to 7 inches; very dark gray (10YR 3/1) silt loam, gray (10YR 5/1) dry; weak fine granular structure; friable; slightly acid; abrupt smooth boundary.

E1—7 to 9 inches; gray (10YR 5/1) and dark gray (10YR 4/1) silt loam, light gray (10YR 7/1) dry; few fine distinct brown (7.5YR 5/4) and strong brown (7.5YR 5/6) mottles; moderate medium platy structure; friable; light gray (10YR 7/1) dry silt coatings on faces of peds; slightly acid; abrupt smooth boundary.

E2—9 to 15 inches; gray (10YR 5/1) silty clay loam, light gray (10YR 6/1) dry; few fine distinct strong brown (7.5YR 5/6 and 5/8) mottles; weak thin platy structure parting to weak coarse subangular blocky; light gray (10YR 7/1) dry silt coatings on faces of peds; friable; slightly acid; clear smooth boundary.

Bg—15 to 17 inches; dark gray (10YR 4/1) silty clay loam; common fine distinct strong brown (7.5YR 5/6 and 5/8) mottles; moderate medium subangular blocky structure; firm; medium acid; clear smooth boundary.

Btg1—17 to 22 inches; dark gray (10YR 4/1) silty clay; common fine distinct strong brown (7.5YR 5/6 and 5/8) mottles; moderate medium subangular blocky structure; firm; thin nearly continuous very dark gray (10YR 3/1) clay films on faces of peds; medium acid; gradual smooth boundary.

Btg2—22 to 30 inches; gray (10YR 5/1) silty clay; common fine distinct strong brown (7.5YR 5/6 and 5/8) mottles; moderate medium subangular blocky

structure; firm; thin continuous dark gray (10YR 4/1) clay films on faces of peds; slightly acid; gradual smooth boundary.

Btg3—30 to 39 inches; grayish brown (2.5Y 5/2) silty clay loam; common fine distinct strong brown (7.5YR 5/6 and 5/8) mottles; weak medium subangular blocky structure; firm; very dark gray (10YR 3/1) clay flows in root channels; slightly acid; gradual smooth boundary.

BCg—39 to 54 inches; light brownish gray (2.5Y 6/2) silty clay loam; common medium prominent strong brown (7.5YR 5/6 and 5/8) mottles; weak coarse prismatic structure; friable; weak coarse prismatic structure; friable; very dark gray (10YR 3/1) clay flows in root channels; few soft dark accumulations (iron and manganese oxides); slightly acid; gradual smooth boundary.

Cg—54 to 60 inches; light brownish gray (2.5Y 6/2) silty clay loam; common medium prominent strong brown (7.5YR 5/6 and 5/8) mottles; massive; friable; slightly acid.

The solum ranges from 48 to 72 inches in thickness. It is slightly acid to strongly acid.

The A or Ap horizon is very dark gray (10YR 3/1) or very dark grayish brown (10YR 3/2). The E horizon has value of 4 to 6 and chroma of 1 or 2. It is 8 to 12 inches thick. The Bg horizon is dark gray (10YR 4/1), gray (10YR 5/1), or grayish brown (10YR 5/2). The Btg horizon has hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 1 or 2. The maximum clay content in this horizon is 38 to 48 percent.

Watkins Series

The Watkins series consists of moderately well drained, moderately permeable soils on stream terraces. These soils formed in silty alluvium. The native vegetation was mixed prairie grasses and deciduous trees. Slopes range from 1 to 5 percent.

Typical pedon of Watkins silt loam, 1 to 5 percent slopes, in a cultivated field; 100 feet south and 1,220 feet west of the center of sec. 15, T. 77 N., R. 7 W.

Ap—0 to 8 inches; very dark grayish brown (10YR 3/2) silt loam, grayish brown (10YR 5/2) dry; weak fine granular structure; friable; slightly acid; abrupt smooth boundary.

E1—8 to 11 inches; dark grayish brown (10YR 4/2) and brown (10YR 5/3) silt loam, grayish brown (10YR 5/2) dry; few very dark grayish brown (10YR 3/2) organic coatings on faces of peds; moderate thin platy structure; friable; white (10YR 8/2) dry silt coatings on faces of peds; slightly acid; clear smooth boundary.

E2—11 to 14 inches; dark grayish brown (10YR 4/2) and brown (10YR 4/3) silt loam, pale brown (10YR 6/3) dry; few very dark grayish brown (10YR 3/2) organic coatings on faces of peds; moderate medium and weak thin platy structure; friable; white (10YR 8/2) dry silt coatings on faces of peds; medium acid; clear smooth boundary.

Bt1—14 to 20 inches; brown (10YR 4/3) and dark yellowish brown (10YR 4/4) silty clay loam; moderate fine and medium subangular blocky structure; friable; very thin discontinuous dark yellowish brown (10YR 4/4) and dark brown (10YR 3/3) clay films on faces of peds; common discontinuous white (10YR 8/2) dry silt coatings on faces of peds; strongly acid; gradual smooth boundary.

Bt2—20 to 25 inches; brown (10YR 4/3) silty clay loam; few fine faint yellowish brown (10YR 5/4 and 5/6) mottles; moderate medium subangular blocky structure; friable; thin nearly continuous dark brown (10YR 3/3) and dark yellowish brown (10YR 3/4 and 4/4) clay films on faces of peds; common discontinuous white (10YR 8/2) dry silt coatings on faces of peds; strongly acid; gradual smooth boundary.

Bt3—25 to 31 inches; brown (10YR 4/3) silty clay loam; few fine faint yellowish brown (10YR 5/4 and 5/6) mottles; moderate medium subangular blocky structure; friable; thin discontinuous dark yellowish brown (10YR 3/4 and 4/4) clay films on faces of peds; common discontinuous white (10YR 8/2) dry silt coatings on faces of peds; very few very fine dark concretions (iron and manganese oxides); strongly acid; gradual smooth boundary.

Bt4—31 to 37 inches; yellowish brown (10YR 5/4) silty clay loam; common fine faint yellowish brown (10YR 5/6) and common fine distinct grayish brown (10YR 5/2) mottles; weak medium prismatic structure parting to moderate fine and medium subangular blocky; friable; thin discontinuous brown (7.5YR 4/2 and 4/4 and 10YR 4/3) clay films on faces of peds; common discontinuous white (10YR 8/2) dry silt coatings on faces of peds; common small dark concretions (iron and manganese oxides); strongly acid; gradual smooth boundary.

Bt5—37 to 44 inches; yellowish brown (10YR 5/4) silty clay loam; common fine distinct yellowish brown (10YR 5/6), reddish brown (5YR 4/4), and strong brown (7.5YR 5/6) mottles; weak medium prismatic structure parting to weak medium subangular blocky; friable; thin patchy brown (7.5YR 4/4 and 4/2) clay films on vertical faces of prisms; few discontinuous white (10YR 8/2) dry silt coatings on faces of peds; common fine dark concretions (iron and manganese oxides); medium acid; gradual smooth boundary.

BC—44 to 49 inches; light olive brown (2.5Y 5/4) and light brownish gray (2.5Y 6/2) silty clay loam; common fine distinct strong brown (7.5YR 5/6), reddish brown (5YR 4/4), and yellowish brown (10YR 5/6) mottles; weak coarse prismatic

structure; friable; few patchy brown (7.5YR 4/4 and 4/2) clay films on vertical faces of prisms; common fine dark concretions (iron and manganese oxides); medium acid; gradual smooth boundary.

C1—49 to 55 inches; light brownish gray (2.5Y 6/2) silt loam; many medium prominent strong brown (7.5YR 5/6) mottles; massive with vertical cleavage; friable; many fine and medium dark concretions (iron and manganese oxides); medium acid; gradual smooth boundary.

C2—55 to 60 inches; light brownish gray (2.5Y 6/2) loam; many medium distinct yellowish brown (10YR 5/6) mottles; massive; friable; many dark concretions (manganese and iron oxides); medium acid.

The solum ranges from 30 to 60 inches in thickness. The A or Ap horizon has hue of 10YR, value of 3, and chroma of 1 or 2. The E horizon is generally dark grayish brown (10YR 4/2) or brown (10YR 4/3 or 10YR 5/3). It has value of 3, however, in coatings on faces of peds or mixed with lighter colors in peds. The Bt horizon has hue of 10YR, value of 4 or 5, and chroma of 3 to 5. It is medium acid or strongly acid. The BC and C horizons have hue of 2.5Y or 10YR, value of 4 to 6, and chroma of 2 to 4. Mottles with chroma of 2 are as shallow as 30 inches in some pedons. The upper 20 inches of the argillic horizon has a clay content of 30 to 35 percent. The C horizon is stratified below a depth of 40 inches.

Wiota Series

The Wiota series consists of moderately well drained, moderately permeable soils on stream terraces. These soils formed in silty alluvium. The native vegetation was mixed prairie grasses. Slopes range from 1 to 5 percent.

Typical pedon of Wiota silty clay loam, 1 to 5 percent slopes, in a hayfield; 1,540 feet north and 900 feet east of the southwest corner of sec. 12, T. 77 N., R. 8 W.

Ap—0 to 10 inches; black (10YR 2/1) silty clay loam, dark gray (10YR 4/1) dry; weak fine granular structure; friable; slightly acid; abrupt smooth boundary.

A—10 to 19 inches; very dark brown (10YR 2/2) silty clay loam, dark grayish brown (10YR 4/2) dry; weak fine subangular blocky structure parting to weak fine granular; friable; slightly acid; gradual smooth boundary.

BA—19 to 25 inches; brown (10YR 4/3) silty clay loam; common very dark grayish brown (10YR 3/2) coatings on faces of peds; weak fine subangular blocky structure; friable; medium acid; gradual smooth boundary.

Bt1—25 to 32 inches; yellowish brown (10YR 5/4) silty clay loam; few fine distinct grayish brown (2.5Y 5/2) and strong brown (7.5YR 5/8) mottles; weak fine subangular blocky structure; firm; thin discontinuous dark grayish brown (10YR 4/2) clay films on faces of peds; few dark concretions (iron and manganese oxides); medium acid; gradual smooth boundary.

Bt2—32 to 41 inches; yellowish brown (10YR 5/4) silty clay loam; common fine distinct grayish brown (2.5Y 5/2) and strong brown (7.5YR 5/8) mottles; weak medium subangular blocky structure; firm; thin discontinuous dark grayish brown (10YR 4/2) clay films on faces of peds; few dark concretions (iron and manganese oxides); slightly acid; gradual smooth boundary.

BC—41 to 51 inches; mottled yellowish brown (10YR 5/4), grayish brown (2.5Y 5/2), and strong brown (7.5YR 5/8) silty clay loam; weak medium prismatic structure; friable; few dark concretions (iron and manganese oxides); slightly acid; gradual smooth boundary.

C—51 to 60 inches; mottled yellowish brown (10YR 5/4) and grayish brown (2.5Y 5/2) silt loam; massive; friable; few strong brown (7.5YR 5/8) iron accumulations; few organic coatings in root channels; few light grainy coatings; slightly acid.

The solum ranges from 36 to 60 inches in thickness. It is neutral to strongly acid. The mollic epipedon ranges from 18 to 26 inches in thickness. In some pedons it includes the upper part of the B horizon.

The Ap and A horizons are silt loam or silty clay loam that has a clay content of about 24 to 32 percent. They have hue of 10YR, value of 2 or 3, and chroma of 1 or 2. The Bt horizon has a clay content of 32 to 36 percent. It has hue of 10YR, value of 4 or 5, and chroma of 3 or 4. Mottles with chroma of 2 are as shallow as 25 inches in most pedons. The C horizon ranges from silty clay loam to sand.

Zook Series

The Zook series consists of poorly drained, slowly permeable soils on flood plains and in upland drainageways. These soils formed in alluvium. The native vegetation was swamp grasses, sedges, and prairie grasses that can tolerate wetness. Slopes range from 0 to 3 percent.

Typical pedon of Zook silty clay loam, in an area of Colo-Zook silty clay loams, 0 to 3 percent slopes, in a hayfield; 1,840 feet south and 380 feet west of the northeast corner of sec. 35, T. 77 N., R. 8 W.

Ap—0 to 6 inches; black (10YR 2/1 and N 2/0) silty clay loam (35 percent clay), very dark gray (10YR 3/1) and dark gray (10YR 4/1) dry; weak fine granular structure; firm; neutral; abrupt smooth boundary.

A1—6 to 16 inches; black (N 2/0) silty clay (43 percent clay), black (10YR 2/1) dry; weak fine subangular blocky structure parting to weak very fine subangular

blocky; firm; sheen on faces of peds; neutral; gradual smooth boundary.

A2—16 to 30 inches; very dark gray (10YR 3/1) silty clay (40 percent clay), dark gray (10YR 4/1) and gray (10YR 5/1) dry; black (N 2/0) coatings on faces of peds; moderate medium subangular blocky structure; firm; sheen on faces of peds; few medium concretions (iron and manganese oxides); neutral; gradual smooth boundary.

A3—30 to 41 inches; very dark gray (10YR 3/1) silty clay loam (37 percent clay); black (N 2/0) coatings on faces of peds; few fine distinct grayish brown (2.5Y 5/2) and strong brown (7.5YR 5/8) mottles; weak medium prismatic structure parting to moderate medium subangular blocky; firm; few medium concretions (iron and manganese oxides); neutral; gradual smooth boundary.

Bg—41 to 54 inches; gray (5Y 5/1) silty clay (44 percent clay); common fine prominent strong brown (7.5YR 5/8) mottles; moderate medium prismatic structure; very firm; very thin discontinuous clay films on faces of prisms; very dark gray (10YR 3/1) clay flows in root channels; few medium concretions (iron and manganese oxides); neutral; gradual smooth boundary.

Cg—54 to 60 inches; gray (5Y 5/1) silty clay loam (39 percent clay); many medium prominent strong brown (7.5YR 5/8) mottles; massive; friable; few medium concretions (iron and manganese oxides); slightly acid.

The solum ranges from about 36 to 60 inches in thickness. It typically is neutral or slightly acid, but some pedons are mildly alkaline to a depth of 50 inches or more. These pedons are not calcareous within that depth. The solum is silty clay loam or silty clay that has a clay content of 32 to 44 percent in the upper 16 inches. The lower part of the profile has a clay content of 36 to 45 percent. The mollic epipedon ranges from 36 to 50 inches in thickness.

The A horizon is black (10YR 2/1 or N 2/0) in the upper part and black (10YR 2/1 or N 2/0) or very dark gray (10YR 3/1) in the lower part. The Bg and Cg horizons are black (10YR 2/1), very dark gray (10YR 3/1), dark gray (10YR to 5Y 4/1), or gray (5Y 5/1).

Formation of the Soils

This section describes factors that affected the formation of the soils in Washington County. Soil forms through processes that act on deposited or accumulated geological material (*7*). The characteristics of the soil at any given point are determined by the physical and mineralogical composition of the parent material; the climate under which the soil material has accumulated and existed since accumulation; the plant and animal life on and in the soil; the relief, or lay of the land; the length of time that the forces of soil formation have acted on the soil material; and human activities.

Climate and vegetation are the active factors of soil formation. They act on the parent material that has accumulated through the weathering of rocks and slowly change it into a natural body that has genetically related horizons. The effects of climate and vegetation are conditioned by relief. The parent material affects the kind of profile that can be formed and, in extreme cases, determines it almost entirely. Time is needed for changing parent material into a soil. Some time is required for horizon differentiation. A long period generally is required for the development of distinct horizons.

The factors of soil formation are so closely interrelated in their effects on the soil that few generalizations can be made regarding the effect of any one factor unless conditions are specified for the others.

Parent Material

The accumulation of parent material is the first step in the formation of a soil. Some of the soils in the county formed as the result of the weathering of bedrock. Most of the soils, however, formed in material that was transported from the site of the parent rock and redeposited at a new location through the action of glacial ice, water, wind, and gravity. The principal parent materials are loess, glacial drift, alluvium, and eolian, or wind-deposited, sand. Much less extensive is residuum.

Loess is the most extensive parent material in the county. It is eolian material made up of dominantly silt-sized particles and some clay. It does not contain coarse sand and gravel, which were too large to be moved by the wind, but it does contain very small amounts of fine sand and very fine sand, generally less than 5 percent. It is deposited in most of the upland areas, mantling about 90 percent of the total acreage of the county. It is about 10 to 15 feet thick on the more stable ridges. Typically, the steeper and less stable the area, the thinner the deposit. The loess mantles glacial till, limestone, and sandstone bedrock and stratified, coarse textured material on benches. The base of the Wisconsin loess in Iowa is 16,500 to 29,000 years old (*16*).

Clinton, Inton, Nira, Mahaska, Kalona, Taintor, Ladoga, Otley, Hedrick, Givin, Rubio, Sperry, and Keomah soils formed from loess that is at least 60 inches thick. A thin layer of loess commonly mantles other soils in the county. Examples are Keswick and Clarinda soils, which formed dominantly in a paleosol derived from glacial till.

Glacial drift is rock material transported and deposited by glacial ice or running water from melting glacial ice. It includes glacial till, which is unsorted sediment ranging in size from boulders to clay particles (*16*). At least two major glaciations during the Pleistocene age affected Washington County. The record of these invasions is contained in the unconsolidated rock material that was deposited by the melting ice and meltwater streams. The first glaciation is referred to as the Nebraskan (*12*). It was followed by the Aftonian interglacial period. The next stage of glaciation, called the Kansan, occurred about 500,000 years ago. The period following the Kansan is referred to as the Yarmouth-Sangamon interglacial period. Both the Nebraskan and Kansan glaciers covered all of Washington County.

Since the Kansan till is several feet thick, the Nebraskan till is not readily evident. In some of the deepest road cuts along a few of the major streams, gumbotil is below the Kansan till. This is generally referred to as Aftonian Gumbotil (*8, 10*). It is the soil that formed during the Aftonian interglacial stage.

Soils formed on the Kansan till plain during the Yarmouth and Sangamon interglacial stages before the loess was deposited. On nearly level interstream divides, the soils were strongly weathered and had a gray, very slowly permeable, clayey subsoil. These very old soils are called paleosols. They significantly influence the landscape of the county. Ashgrove, Clarinda, and Rinda soils formed almost entirely in this gray paleosol. Geologic erosion subsequently cut below the Yarmouth-Sangamon paleosol into the Kansas till and older deposits. At the depth to which this erosion cut, there generally is a stone line or subjacent till that is overlain by pedisediment (*14, 19*). A reddish brown paleosol formed in both the pedisediment and the subjacent glacial till. Since this paleosol formed after the

Yarmouth-Sangamon interglacial period, it is called the Late Sangamon paleosol (*14, 15*). A stone line typically is near or at the surface of the paleosol. Adair, Armstrong, and Keswick soils formed in the Late Sangamon paleosol.

Douds, Galland, and Mystic soils formed in pre-Late Sangamon sediments of valley fills. These alluvial and colluvial sediments are of glacial origin. They vary more in texture than glacial till, however, because they are angularly truncated by valley slopes and have been sorted by water. Douds, Galland, and Mystic soils are on low-stepped interfluves above the present drainage system. They are partly in areas of pre-Late Sangamon valley fill, but their surface merges with the present erosional uplands (*20*). These soils are distinctly higher on the landscape than the soils on bottom land and on stream terraces. They are lower on the landscape than Gara, Lindley, and Shelby soils, which formed in Kansan till on dissected slopes of Late Wisconsin age.

Alluvium is sediment that has been transported and sorted by water. The alluvial deposits in Washington County are of Late Wisconsin age. They are on both bottom land and stream terraces. Since the alluvium is derived mainly from glacial till and loess, it is predominantly silt and clay, silt and sand, or sand and gravel. The deposits vary in thickness. They are typically much thicker along the major streams and rivers than along the smaller streams.

Areas of more sandy and loamy sediment are along the Skunk River, Crooked Creek (fig. 11), and their tributaries in the southern third of the county. The coarser texture of this sediment probably results from the generally coarser textured source material adjacent to the tributaries and from a faster stream velocity. Silty sediments generally are adjacent to the English River, the Iowa River, and their tributaries in the northern two-thirds of the county.

As a river overflows its channels and the water spreads over the flood plains, coarse textured material is deposited first, adjacent either to the stream or river banks or to old oxbows on the flood plains. Perks soils are an example of sandy soils that formed in this material. As the floodwater continues to spread, it moves more slowly and silty material is deposited. Nodaway and Lawson soils formed in this material. After the flooding has ceased, the finest textured material, which consists of clay particles, settles from the water that is left standing on the lowest parts of the flood plains. Colo,

Figure 11.—Soils that formed in alluvium on bottom land along Crooked Creek. Complex soil patterns are typical in the areas adjacent to the creek.

Figure 12.—An area in the basin of Lake Calvin in the northern part of Washington County, adjacent to the English River.

Humeston, and Zook soils formed in this slack-water material.

Lake Calvin is the name given to an extensive lowland area that is a distinctive topographic feature in southeastern Iowa (*1, 17*). It includes large parts of Cedar, Johnson, Louisa, and Muscatine Counties. It is typified by sharply defined bluffs, which outline the basin. Areas of uplands outside the basin have a rolling topography. Areas within the basin have a more nearly level terrain (fig. 12). The basin is generally bounded on the north and west by uplands of loess-mantled Kansan glacial drift and on the east by uplands of loess-mantled Illinoin drift (*9*).

Areas in Washington County that are affected by Lake Calvin are adjacent to the English and Iowa Rivers and probably most of their tributaries. The towns of Kalona and Riverside are within the gently sloping to level basin area of Lake Calvin. Two different levels of terraces are in the part of the basin that is in Washington County. Wiota, Watkins, Koszta, Nevin, Bremer, Tuskeego, Dickinson, and Elrin soils formed in alluvium in the basin.

Eolian sand and some *alluvial sand* are deposited on the uplands and terraces in Washington County. Chelsea, Billet, and Lamont soils are dominantly wind-deposited sands intermingled with loess in the uplands. These sandy soils generally are in areas adjacent to the English River, the West Fork of Crooked Creek, and Davis Creek and in a few other scattered areas. Although these areas are typically considered eolian, some of the sand has probably been reworked by water. Other areas of sandy soils are on the stream terraces in the county. These are the Dickinson and Sparta soils.

Normally thought to be deposited by wind, these soils may be alluvial deposits in some areas in the county. The sand is mainly fine and very fine quartz, which is highly resistant to weathering. It typically has not been altered appreciably since deposition.

Residiuum is material weathered in place from sedimentary rocks. Limestone and sandstone are the two major types of sedimentary rocks in the county, although they are a very small source of parent material. The underlying bedrock in most of the county belongs to the Mississippian System. In some areas in the northern part of the county, however, it belongs to the Upper Devonian System. Part of the solum of Nordness silt loam formed in material weathered from limestone. This is the only soil in the county that formed in this material.

Climate

The soils in Washington County have been forming under the influence of a midcontinental, subhumid climate for at least 5,000 years. Between 5,000 and 16,000 years ago, the climate was conducive to the growth of forest vegetation (*14, 24*). Soil morphology generally indicates that the climate under which the soils formed is similar to the present one. The present climate is fairly uniform throughout the county but is marked by wide seasonal extremes in temperature. Precipitation is distributed throughout the year.

Climate has a major effect on the plants that grow on the soil. Temperature, rainfall, relative humidity, and the length of the frost-free period are important in determining the kind of vegetation. The rates of hydrolysis, carbonation, oxidation, and other important chemical reactions in the soil are influenced by climate.

The influence of the general climate in a region is somewhat modified by local conditions in or near the soils. For example, soils on south-facing slopes formed under a microclimate that has been warmer and drier than the microclimate of nearby areas. Also, low lying, poorly drained soils are wetter and colder than most of the better drained soils around them.

Plant and Animal Life

Plant and animal life has important effects on soil formation. Vegetation influences the content of organic matter, the color and thickness of the surface layer, the content of plant nutrients, and soil reaction. Earthworms and burrowing animals help to keep the soil porous and thus improve aeration. Bacteria and fungi decompose vegetation, thus releasing plant nutrients.

Native prairie grasses, which have a myriad of fibrous roots that extend to a depth of 10 to more than 20 inches, add large amounts of organic matter to the surface layer. Tree roots are much deeper, are not so fibrous, and add very little organic matter to the surface layer.

Otley, Ladoga, and Clinton soils are a biosequence of soils that formed in similar kinds of parent material and under similar environmental conditions, except for the native vegetation. Otley soils, which have a thick, dark surface layer, formed under prairie grasses. Clinton soils, which have a thin, light colored surface layer, formed under forest vegetation. The surface layer of Ladoga soils, which probably formed under a combination of both prairie grasses and trees, is intermediate in thickness and color between that of the Otley soils and that of the Clinton soils.

Relief

Relief indirectly affects soil formation through its effect on drainage, runoff, the rate of water infiltration, and erosion. Water soaks into nearly level soils that are not flooded. Where the slope is steeper, more water runs off the surface and less infiltrates the soil. The less the amount of water that infiltrates the soil, the thinner the soil profile. The Lindley soils having a slope of 25 to 40 percent have a thinner, less well developed soil profile than the Lindley soils having a slope of 9 to 14 percent. Also, carbonates are closer to the surface in the steeper Lindley soils. The maximum clay content in the B horizon and the depth to the layer that has the highest content of clay decrease with increasing slope (*4, 11*).

Otley, Mahaska, and Taintor are examples of soils that formed in similar kinds of parent material and under similar vegetation but that differ because of their landscape position. Otley soils are in gently sloping to strongly sloping areas and are moderately well drained. Mahaska soils are nearly level and very gently sloping, are on long slopes, and are somewhat poorly drained. Taintor soils are nearly level, are on broad upland flats, and are poorly drained. In depressions where water collects or ponds, the soils are very poorly drained and have a silty, light colored subsurface layer and a dense, clayey subsoil. Sperry soils are an example.

Aspect has a significant influence on soil formation. South-facing slopes generally are warmer and drier than north-facing slopes. As a result, they support a different kind and amount of vegetation.

The influence of porous, rapidly permeable parent material can override the effects of topography. The nearly level Dickinson soils, for example, are somewhat excessively drained because they are moderately rapidly permeable in the upper part and rapidly permeable in the lower part.

Time

The length of time that parent material remains in place and is acted on by the soil-forming processes affects the kind of soil that forms. The older soils are strongly developed and have well defined genetic horizons. The subsoil becomes finer textured with the

passage of time. The content of clay in the subsoil is as much as 58 percent in soils that formed in a clayey paleosol. An example is Clarinda soils, which formed over a period of several hundred thousand years. The more recent soils, such as Shelby soils, which formed in the same Kansan till, typically have a clay content of less than 35 percent in the subsoil.

Soils that formed in recent alluvium show very little if any evidence of genetic horizon development. Nodaway soils are an example of very young soils. They formed in recent deposits of stratified, silty alluvium.

Resistance to weathering can modify the effect of time on soil formation. Soils that formed in material that is resistant to weathering, such as quartz sand, do not change much with the passage of time. Chelsea and Sparta soils are examples.

Organic material that has been buried under sediments deposited by water, ice, or wind can be helpful in determining the age of a landscape. Determining the age of the organic material by a process known as radiocarbon dating helps to ascertain the age of the sediments above the organic material (*18*). Radiocarbon dates indicate that the loess deposits in Washington County are about 14,000 to 20,000 years old.

Human Activities

Many changes have taken place since Washington County was first settled. Breaking the sod and clearing the timber removed the protective plant cover. Cultivation increased the runoff rate dramatically, creating rills and gullies throughout the landscape. Sheet erosion, which is the most prevalent type of erosion, removed a few inches of topsoil at a time. Further cultivation temporarily masked these effects on the landscape. Within a few years, however, the brownish subsoil was slowly exposed. Accelerated erosion eventually removed part or all of the original surface layer from many of the more sloping soils.

Accelerated erosion slowly changed many important characteristics of the soils. The content of organic matter in the surface layer was reduced. Heavier applications of nitrogen fertilizer are now needed to maintain the productivity of the eroded soils. Cultivation and erosion resulted in poorer tilth. They slowly changed the soil structure, consistence, and the texture of the surface layer. In severely eroded areas the surface layer is mostly subsoil material, which is less friable and has more clay than the original surface layer. The granular structure of soils formed under prairie grasses breaks down under intensive cultivation. Soils that have been severely eroded tend to bake and harden when they dry. If tilled when wet, they tend to puddle and have a slower infiltration rate than the soils in undisturbed areas.

Additions of commercial fertilizer and lime have counteracted deficiencies in plant nutrients. As a result, some soils are more productive than they were in their natural state. In large areas on bottom land, productivity has been increased by diversions at the base of slopes, by ditches, and by levees, which help to prevent flooding. The diversions help to control runoff from the adjacent upland slopes. Tile drainage has increased the productivity of the soils on bottom land and the soils on broad upland flats, such as those in the Mahaska-Taintor-Kalona association.

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Glossary

Aeration, soil. The exchange of air in soil with air from the atmosphere. The air in a well aerated soil is similar to that in the atmosphere; the air in a poorly aerated soil is considerably higher in carbon dioxide and lower in oxygen.

Aggregate, soil. Many fine particles held in a single mass or cluster. Natural soil aggregates, such as granules, blocks, or prisms, are called peds. Clods are aggregates produced by tillage or logging.

Alluvium. Material, such as sand, silt, or clay, deposited on land by streams.

Area reclaim (in tables). An area difficult to reclaim after the removal of soil for construction and other uses. Revegetation and erosion control are extremely difficult.

Association, soil. A group of soils geographically associated in a characteristic repeating pattern and defined and delineated as a single map unit.

Available water capacity (available moisture capacity). The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field moisture capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil. The capacity, in inches, in a 60-inch profile or to a limiting layer is expressed as—

	Inches
Very low	0 to 3
Low	3 to 6
Moderate	6 to 9
High	9 to 12
Very high	more than 12

Base saturation. The degree to which material having cation exchange properties is saturated with exchangeable bases (sum of Ca, Mg, Na, K), expressed as a percentage of the total cation exchange capacity.

Bedding system. A drainage system made by plowing, grading, or otherwise shaping the surface of a flat field. It consists of a series of low ridges separated by shallow, parallel dead furrows.

Bedrock. The solid rock that underlies the soil and other unconsolidated material or that is exposed at the surface.

Bottom land. The normal flood plain of a stream, subject to flooding.

Calcareous soil. A soil containing enough calcium carbonate (commonly combined with magnesium carbonate) to effervesce visibly when treated with cold, dilute hydrochloric acid.

Catena. A sequence, or "chain," of soils on a landscape that formed in similar kinds of parent material but have different characteristics as a result of differences in relief and drainage.

Cation. An ion carrying a positive charge of electricity. The common soil cations are calcium, potassium, magnesium, sodium, and hydrogen.

Cation-exchange capacity. The total amount of exchangeable cations that can be held by the soil, expressed in terms of milliequivalents per 100 grams of soil at neutrality (pH 7.0) or at some other stated pH value. The term, as applied to soils, is synonymous with base-exchange capacity, but is more precise in meaning.

Chiseling. Tillage with an implement having one or more soil-penetrating points that shatter or loosen hard compacted layers to a depth below normal plow depth.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Clay film. A thin coating of oriented clay on the surface of a soil aggregate or lining pores or root channels. Synonyms: clay coating, clay skin.

Coarse fragments. If round, mineral or rock particles 2 millimeters to 25 centimeters (10 inches) in diameter; if flat, mineral or rock particles (flagstone) 15 to 38 centimeters (6 to 15 inches) long.

Coarse textured soil. Sand or loamy sand.

Colluvium. Soil material, rock fragments, or both moved by creep, slide, or local wash and deposited at the base of steep slopes.

Complex slope. Irregular or variable slope. Planning or constructing terraces, diversions, and other water-control measures on a complex slope is difficult.

Complex, soil. A map unit of two or more kinds of soil in such an intricate pattern or so small in area that it is not practical to map them separately at the selected scale of mapping. The pattern and proportion of the soils are somewhat similar in all areas.

Concretions. Grains, pellets, or nodules of various sizes, shapes, and colors consisting of concentrated compounds or cemented soil grains. The composition of most concretions is unlike that of the surrounding soil. Calcium carbonate and iron oxide are common compounds in concretions.

Conservation tillage. A tillage system that does not invert the soil and that leaves a protective amount of crop residue on the surface throughout the year.

Consistence, soil. The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are—
Loose.—Noncoherent when dry or moist; does not hold together in a mass.
Friable.—When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.
Firm.—When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.
Plastic.—When wet, readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger.
Sticky.—When wet, adheres to other material and tends to stretch somewhat and pull apart rather than to pull free from other material.
Hard.—When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.
Soft.—When dry, breaks into powder or individual grains under very slight pressure.
Cemented.—Hard; little affected by moistening.

Contour stripcropping. Growing crops in strips that follow the contour. Strips of grass or close-growing crops are alternated with strips of clean-tilled crops or summer fallow.

Control section. The part of the soil on which classification is based. The thickness varies among different kinds of soil, but for many it is that part of the soil profile between depths of 10 inches and 40 or 80 inches.

Corrosive. High risk of corrosion to uncoated steel or deterioration of concrete.

Cutbanks cave (in tables). The walls of excavations tend to cave in or slough.

Deferred grazing. Postponing grazing or resting grazing land for a prescribed period.

Depth to rock (in tables). Bedrock is too near the surface for the specified use.

Diversion (or diversion terrace). A ridge of earth, generally a terrace, built to protect downslope areas by diverting runoff from its natural course.

Drainage class (natural). Refers to the frequency and duration of periods of saturation or partial saturation during soil formation, as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation but may be caused by the sudden deepening of channels or the blocking of drainage outlets. Seven classes of natural soil drainage are recognized:
Excessively drained.—Water is removed from the soil very rapidly. Excessively drained soils are commonly very coarse textured, rocky, or shallow. Some are steep. All are free of the mottling related to wetness.
Somewhat excessively drained.—Water is removed from the soil rapidly. Many somewhat excessively drained soils are sandy and rapidly pervious. Some are shallow. Some are so steep that much of the water they receive is lost as runoff. All are free of the mottling related to wetness.
Well drained.—Water is removed from the soil readily, but not rapidly. It is available to plants throughout most of the growing season, and wetness does not inhibit growth of roots for significant periods during most growing seasons. Well drained soils are commonly medium textured. They are mainly free of mottling.
Moderately well drained.—Water is removed from the soil somewhat slowly during some periods. Moderately well drained soils are wet for only a short time during the growing season, but periodically they are wet long enough that most mesophytic crops are affected. They commonly have a slowly pervious layer within or directly below the solum, or periodically receive high rainfall, or both.
Somewhat poorly drained.—Water is removed slowly enough that the soil is wet for significant periods during the growing season. Wetness markedly restricts the growth of mesophytic crops unless artificial drainage is provided. Somewhat poorly drained soils commonly have a slowly pervious layer, a high water table, additional water from seepage, nearly continuous rainfall, or a combination of these.
Poorly drained.—Water is removed so slowly that the soil is saturated periodically during the growing season or remains wet for long periods. Free water is commonly at or near the surface for long enough during the growing season that most mesophytic crops cannot be grown unless the soil is artificially drained. The soil is not continuously saturated in layers directly below plow depth. Poor drainage results from a high water table, a slowly pervious layer within the profile, seepage, nearly continuous rainfall, or a combination of these.
Very poorly drained.—Water is removed from the soil so slowly that free water remains at or on the surface during most of the growing season. Unless the soil is artificially drained, most mesophytic crops cannot be grown. Very poorly drained soils are commonly level or depressed and are frequently ponded. Yet, where rainfall is high and nearly

continuous, they can have moderate or high slope gradients.

Drainage, surface. Runoff, or surface flow of water, from an area.

Eolian soil material. Earthy parent material accumulated through wind action; commonly refers to sandy material in dunes or to loess in blankets on the surface.

Erosion. The wearing away of the land surface by water, wind, ice, or other geologic agents and by such processes as gravitational creep.

Erosion (geologic). Erosion caused by geologic processes acting over long geologic periods and resulting in the wearing away of mountains and the building up of such landscape features as flood plains and coastal plains. Synonym: natural erosion.

Erosion (accelerated). Erosion much more rapid than geologic erosion, mainly as a result of the activities of man or other animals or of a catastrophe in nature, for example, fire, that exposes the surface.

Excess fines (in tables). Excess silt and clay in the soil. The soil is not a source of gravel or sand for construction purposes.

Fertility, soil. The quality that enables a soil to provide plant nutrients, in adequate amounts and in proper balance, for the growth of specified plants when light, moisture, temperature, tilth, and other growth factors are favorable.

Field moisture capacity. The moisture content of a soil, expressed as a percentage of the ovendry weight, after the gravitational, or free, water has drained away; the field moisture content 2 or 3 days after a soaking rain; also called *normal field capacity, normal moisture capacity,* or *capillary capacity.*

Fine textured soil. Sandy clay, silty clay, and clay.

First bottom. The normal flood plain of a stream, subject to frequent or occasional flooding.

Flood plain. A nearly level alluvial plain that borders a stream and is subject to flooding unless protected artificially.

Foot slope. The inclined surface at the base of a hill.

Frost action (in tables). Freezing and thawing of soil moisture. Frost action can damage roads, buildings and other structures, and plant roots.

Genesis, soil. The mode of origin of the soil. Refers especially to the processes or soil-forming factors responsible for the formation of the solum, or true soil, from the unconsolidated parent material.

Glacial drift (geology). Pulverized and other rock material transported by glacial ice and then deposited. Also the sorted and unsorted material deposited by streams flowing from glaciers.

Glacial outwash (geology). Gravel, sand, and silt, commonly stratified, deposited by glacial meltwater.

Glacial till (geology). Unsorted, nonstratified glacial drift consisting of clay, silt, sand, and boulders transported and deposited by glacial ice.

Gleyed soil. Soil that formed under poor drainage, resulting in the reduction of iron and other elements in the profile and in gray colors and mottles.

Grassed waterway. A natural or constructed waterway, typically broad and shallow, seeded to grass as protection against erosion. Conducts surface water away from cropland.

Gravel. Rounded or angular fragments of rock up to 3 inches (2 millimeters to 7.6 centimeters) in diameter. An individual piece is a pebble.

Ground water (geology). Water filling all the unblocked pores of underlying material below the water table.

Gully. A miniature valley with steep sides cut by running water and through which water ordinarily runs only after rainfall. The distinction between a gully and a rill is one of depth. A gully generally is an obstacle to farm machinery and is too deep to be obliterated by ordinary tillage; a rill is of lesser depth and can be smoothed over by ordinary tillage.

Horizon, soil. A layer of soil, approximately parallel to the surface, having distinct characteristics produced by soil-forming processes. In the identification of soil horizons, an uppercase letter represents the major horizons. Numbers or lowercase letters that follow represent subdivisions of the major horizons. The major horizons are as follows:

O horizon.—An organic layer of fresh and decaying plant residue.

A horizon.—The mineral horizon at or near the surface in which an accumulation of humified organic matter is mixed with the mineral material. Also, any plowed or disturbed surface layer.

E horizon.—The mineral horizon in which the main feature is loss of silicate clay, iron, aluminum, or some combination of these.

B horizon.—The mineral horizon below an O, A, or E horizon. The B horizon is in part a layer of transition from the overlying horizon to the underlying C horizon. The B horizon also has distinctive characteristics, such as (1) accumulation of clay, sesquioxides, humus, or a combination of these; (2) granular, prismatic, or blocky structure; (3) redder or browner colors than those in the A horizon; or (4) a combination of these.

C horizon.—The mineral horizon or layer, excluding indurated bedrock, that is little affected by soil-forming processes and does not have the properties typical of the overlying horizon. The material of a C horizon may be either like or unlike that in which the solum formed. If the material is known to differ from that in the solum, an Arabic numeral, commonly a 2, precedes the letter C.

Cr horizon.—Soft, consolidated bedrock beneath the soil.

R layer.—Hard, consolidated bedrock beneath the soil. The bedrock commonly underlies a C horizon but can be directly below an A or a B horizon.

Humus. The well decomposed, more or less stable part of the organic matter in mineral soils.

Hydrologic soil groups. Refers to soils grouped according to their runoff-producing characteristics. The chief consideration is the inherent capacity of soil bare of vegetation to permit infiltration. The slope and the kind of plant cover are not considered but are separate factors in predicting runoff. Soils are assigned to four groups. In group A are soils having a high infiltration rate when thoroughly wet and having a low runoff potential. They are mainly deep, well drained, and sandy or gravelly. In group D, at the other extreme, are soils having a very slow infiltration rate and thus a high runoff potential. They have a claypan or clay layer at or near the surface, have a permanent high water table, or are shallow over nearly impervious bedrock or other material. A soil is assigned to two hydrologic groups if part of the acreage is artificially drained and part is undrained.

Infiltration. The downward entry of water into the immediate surface of soil or other material, as contrasted with percolation, which is movement of water through soil layers or material.

Infiltration capacity. The maximum rate at which water can infiltrate into a soil under a given set of conditions.

Infiltration rate. The rate at which water penetrates the surface of the soil at any given instant, usually expressed in inches per hour. The rate can be limited by the infiltration capacity of the soil or the rate at which water is applied at the surface.

Leaching. The removal of soluble material from soil or other material by percolating water.

Liquid limit. The moisture content at which the soil passes from a plastic to a liquid state.

Loam. Soil material that is 7 to 27 percent clay particles, 28 to 50 percent silt particles, and less than 52 percent sand particles.

Loess. Fine grained material, dominantly of silt-sized particles, deposited by wind.

Low strength. The soil is not strong enough to support loads.

Medium textured soil. Very fine sandy loam, loam, silt loam, or silt.

Mineral soil. Soil that is mainly mineral material and low in organic material. Its bulk density is more than that of organic soil.

Minimum tillage. Only the tillage essential to crop production and prevention of soil damage.

Moderately coarse textured soil. Coarse sandy loam, sandy loam, and fine sandy loam.

Moderately fine textured soil. Clay loam, sandy clay loam, and silty clay loam.

Morphology, soil. The physical makeup of the soil, including the texture, structure, porosity, consistence, color, and other physical, mineral, and biological properties of the various horizons, and the thickness and arrangement of those horizons in the soil profile.

Mottling, soil. Irregular spots of different colors that vary in number and size. Mottling generally indicates poor aeration and impeded drainage. Descriptive terms are as follows: abundance—*few, common,* and *many*; size—*fine, medium,* and *coarse*; and contrast—*faint, distinct,* and *prominent*. The size measurements are of the diameter along the greatest dimension. *Fine* indicates less than 5 millimeters (about 0.2 inch); *medium*, from 5 to 15 millimeters (about 0.2 to 0.6 inch); and *coarse*, more than 15 millimeters (about 0.6 inch).

Munsell notation. A designation of color by degrees of the three simple variables—hue, value, and chroma. For example, a notation of 10YR 6/4 is a color of 10YR hue, value of 6, and chroma of 4.

Neutral soil. A soil having a pH value between 6.6 and 7.3. (See Reaction, soil.)

Nutrient, plant. Any element taken in by a plant essential to its growth. Plant nutrients are mainly nitrogen, phosphorus, potassium, calcium, magnesium, sulfur, iron, manganese, copper, boron, and zinc obtained from the soil and carbon, hydrogen, and oxygen obtained from the air and water.

Organic matter. Plant and animal residue in the soil in various stages of decomposition.

Paleosol. A buried soil or formerly buried soil, especially one that formed during an interglacial period.

Parent material. The unconsolidated organic and mineral material in which soil forms.

Ped. An individual natural soil aggregate, such as a granule, a prism, or a block.

Percolation. The downward movement of water through the soil.

Percs slowly (in tables). The slow movement of water through the soil adversely affecting the specified use.

Permeability. The quality of the soil that enables water to move downward through the profile. Permeability is measured as the number of inches per hour that water moves downward through the saturated soil. Terms describing permeability are:

Very slow	less than 0.06 inch
Slow	0.06 to 0.2 inch
Moderately slow	0.2 to 0.6 inch
Moderate	0.6 inch to 2.0 inches
Moderately rapid	2.0 to 6.0 inches
Rapid	6.0 to 20 inches
Very rapid	more than 20 inches

Phase, soil. A subdivision of a soil series based on features that affect its use and management. For example, slope, stoniness, and thickness.

pH value. A numerical designation of acidity and alkalinity in soil. (See Reaction, soil.)

Piping (in tables). Formation of subsurface tunnels or pipelike cavities by water moving through the soil.

Plasticity index. The numerical difference between the liquid limit and the plastic limit; the range of moisture content within which the soil remains plastic.

Plastic limit. The moisture content at which a soil changes from semisolid to plastic.

Ponding. Standing water on soils in closed depressions. Unless the soils are artificially drained, the water can be removed only by percolation or evapotranspiration.

Poorly graded. Refers to a coarse grained soil or soil material consisting mainly of particles of nearly the same size. Because there is little difference in size of the particles, density can be increased only slightly by compaction.

Poor filter (in tables). Because of rapid permeability the soil may not adequately filter effluent from a waste disposal system.

Productivity, soil. The capability of a soil for producing a specified plant or sequence of plants under specific management.

Profile, soil. A vertical section of the soil extending through all its horizons and into the parent material.

Reaction, soil. A measure of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is described as precisely neutral in reaction because it is neither acid nor alkaline. The degree of acidity or alkalinity is expressed as—

	pH
Extremely acid	below 4.5
Very strongly acid	4.5 to 5.0
Strongly acid	5.1 to 5.5
Medium acid	5.6 to 6.0
Slightly acid	6.1 to 6.5
Neutral	6.6 to 7.3
Mildly alkaline	7.4 to 7.8
Moderately alkaline	7.9 to 8.4
Strongly alkaline	8.5 to 9.0
Very strongly alkaline	9.1 and higher

Relief. The elevations or inequalities of a land surface, considered collectively.

Residuum (residual soil material). Unconsolidated, weathered, or partly weathered mineral material that accumulated as consolidated rock disintegrated in place.

Rooting depth (in tables). Shallow root zone. The soil is shallow over a layer that greatly restricts roots.

Runoff. The precipitation discharged into stream channels from an area. The water that flows off the surface of the land without sinking into the soil is called surface runoff. Water that enters the soil before reaching surface streams is called ground-water runoff or seepage flow from ground water.

Sand. As a soil separate, individual rock or mineral fragments from 0.05 millimeter to 2.0 millimeters in diameter. Most sand grains consist of quartz. As a soil textural class, a soil that is 85 percent or more sand and not more than 10 percent clay.

Sandstone. Sedimentary rock containing dominantly sand-size particles.

Sedimentary rock. Rock made up of particles deposited from suspension in water. The chief kinds of sedimentary rock are conglomerate, formed from gravel; sandstone, formed from sand; shale, formed from clay; and limestone, formed from soft masses of calcium carbonate. There are many intermediate types. Some wind-deposited sand is consolidated into sandstone.

Seepage (in tables). The movement of water through the soil. Seepage adversely affects the specified use.

Series, soil. A group of soils that have profiles that are almost alike, except for differences in texture of the surface layer or of the substratum. All the soils of a series have horizons that are similar in composition, thickness, and arrangement.

Sheet erosion. The removal of a fairly uniform layer of soil material from the land surface by the action of rainfall and surface runoff.

Shrink-swell. The shrinking of soil when dry and the swelling when wet. Shrinking and swelling can damage roads, dams, building foundations, and other structures. It can also damage plant roots.

Silt. As a soil separate, individual mineral particles that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). As a soil textural class, soil that is 80 percent or more silt and less than 12 percent clay.

Similar soils. Soils that share limits of diagnostic criteria, behave and perform in a similar manner, and have similar conservation needs or management requirements for the major land uses in the survey area.

Site index. A designation of the quality of a forest site based on the height of the dominant stand at an arbitrarily chosen age. For example, if the average height attained by dominant and codominant trees in a fully stocked stand at the age of 50 years is 75 feet, the site index is 75 feet.

Slope. The inclination of the land surface from the horizontal. Percentage of slope is the vertical distance divided by horizontal distance, then multiplied by 100. Thus, a slope of 20 percent is a drop of 20 feet in 100 feet of horizontal distance.

Slope (in tables). Slope is great enough that special practices are required to ensure satisfactory performance of the soil for a specific use.

Slow refill (in tables). The slow filling of ponds, resulting from restricted permeability in the soil.

Small stones (in tables). Rock fragments less than 3 inches (7.6 centimeters) in diameter. Small stones adversely affect the specified use of the soil.

Soil. A natural, three-dimensional body at the earth's surface. It is capable of supporting plants and has properties resulting from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief over periods of time.

Soil separates. Mineral particles less than 2 millimeters in equivalent diameter and ranging between specified size limits. The names and sizes of separates recognized in the United States are as follows:

	Millimeters
Very coarse sand	2.0 to 1.0
Coarse sand	1.0 to 0.5
Medium sand	0.5 to 0.25
Fine sand	0.25 to 0.10
Very fine sand	0.10 to 0.05
Silt	0.05 to 0.002
Clay	less than 0.002

Solum. The upper part of a soil profile, above the C horizon, in which the processes of soil formation are active. The solum in soil consists of the A, E, and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the underlying material. The living roots and plant and animal activities are largely confined to the solum.

Stone line. A concentration of coarse fragments in a soil. Generally it is indicative of an old weathered surface. In a cross section, the line may be one fragment or more thick. It generally overlies material that weathered in place and is overlain by recent sediment of variable thickness.

Stripcropping. Growing crops in a systematic arrangement of strips or bands which provide vegetative barriers to wind and water erosion.

Structure, soil. The arrangement of primary soil particles into compound particles or aggregates. The principal forms of soil structure are—*platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular*. *Structureless* soils are either *single grained* (each grain by itself, as in dune sand) or *massive* (the particles adhering without any regular cleavage, as in many hardpans).

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Substratum. The part of the soil below the solum.

Subsurface layer. Any surface soil horizon (A, E, AB, or EB) below the surface layer.

Surface layer. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, ranging in depth from about 4 to 10 inches (10 to 25 centimeters). Frequently designated as the "plow layer," or the "Ap horizon."

Surface soil. The A, E, AB, and EB horizons. It includes all subdivisions of these horizons.

Taxadjuncts. Soils that cannot be classified in a series recognized in the classification system. Such soils are named for a series they strongly resemble and are designated as taxadjuncts to that series because they differ in ways too small to be of consequence in interpreting their use and behavior.

Terrace. An embankment, or ridge, constructed across sloping soils on the contour or at a slight angle to the contour. The terrace intercepts surface runoff so that water soaks into the soil or flows slowly to a prepared outlet.

Terrace (geologic). An old alluvial plain, ordinarily flat or undulating, bordering a river, a lake, or the sea.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are *sand, loamy sand, sandy loam, loam, silt loam, silt, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay,* and *clay*. The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

Thin layer (in tables). Otherwise suitable soil material too thin for the specified use.

Tilth, soil. The physical condition of the soil as related to tillage, seedbed preparation, seedling emergence, and root penetration.

Topsoil. The upper part of the soil, which is the most favorable material for plant growth. It is ordinarily rich in organic matter and is used to topdress roadbanks, lawns, and land affected by mining.

Valley fill. In glaciated regions, material deposited in stream valleys by glacial meltwater. In nonglaciated regions, alluvium deposited by heavily loaded streams.

Weathering. All physical and chemical changes produced in rocks or other deposits at or near the earth's surface by atmospheric agents. These changes result in disintegration and decomposition of the material.

Well graded. Refers to soil material consisting of coarse grained particles that are well distributed over a wide range in size or diameter. Such soil normally can be easily increased in density and bearing properties by compaction. Contrasts with poorly graded soil.

Tables

TABLE 1.--TEMPERATURE AND PRECIPITATION

[Recorded in the period 1951-79 at Washington, Iowa]

Month	Temperature						Precipitation				
	Average daily maximum	Average daily minimum	Average daily	2 years in 10 will have-- Maximum temperature higher than--	2 years in 10 will have-- Minimum temperature lower than--	Average number of growing degree days*	Average	2 years in 10 will have-- Less than--	2 years in 10 will have-- More than--	Average number of days with 0.10 inch or more	Average snowfall
	°F	°F	°F	°F	°F	Units	In	In	In		In
January----	30.0	11.6	20.8	59	-18	0	1.27	0.48	1.92	4	7.5
February---	36.4	17.8	27.1	63	-14	0	1.02	.36	1.56	3	4.3
March------	47.2	27.4	37.3	79	1	35	2.53	1.16	3.69	6	5.1
April------	63.4	40.7	52.1	87	20	134	3.59	2.04	4.97	7	.6
May--------	74.8	51.3	63.1	92	32	412	3.90	2.12	5.46	7	.0
June-------	83.7	60.7	72.2	97	44	666	4.29	2.01	6.25	7	.0
July-------	87.3	64.6	76.0	100	49	806	4.21	2.22	5.96	7	.0
August-----	85.3	62.2	73.8	98	47	738	3.69	1.35	5.63	6	.0
September--	78.2	54.1	66.2	95	34	486	3.39	1.00	5.32	6	.0
October----	67.4	43.4	55.4	89	22	220	2.63	.75	4.15	5	.1
November---	49.9	30.7	40.3	75	5	18	1.89	.70	2.88	4	1.5
December---	36.1	19.3	27.7	63	-11	0	1.57	.63	2.35	4	5.6
Yearly:											
Average--	61.6	40.3	51.0	---	---	---	---	---	---	---	---
Extreme--	---	---	---	100	-19	---	---	---	---	---	---
Total----	---	---	---	---	---	3,515	33.98	26.73	40.82	66	24.7

* A growing degree day is a unit of heat available for plant growth. It can be calculated by adding the maximum and minimum daily temperatures, dividing the sum by 2, and subtracting the temperature below which growth is minimal for the principal crops in the area (50 degrees F).

TABLE 2.--FREEZE DATES IN SPRING AND FALL

[Recorded in the period 1951-79 at Washington, Iowa]

Probability	Temperature		
	24° F or lower	28° F or lower	32° F or lower
Last freezing temperature in spring:			
1 year in 10 later than--	Apr. 14	Apr. 24	May 5
2 years in 10 later than--	Apr. 10	Apr. 19	Apr. 30
5 years in 10 later than--	Apr. 1	Apr. 10	Apr. 22
First freezing temperature in fall:			
1 year in 10 earlier than--	Oct. 20	Oct. 11	Sept. 29
2 years in 10 earlier than--	Oct. 25	Oct. 16	Oct. 4
5 years in 10 earlier than--	Nov. 3	Oct. 25	Oct. 15

TABLE 3.--GROWING SEASON

[Recorded in the period 1951-79 at Washington, Iowa]

Probability	Daily minimum temperature during growing season		
	Higher than 24° F	Higher than 28° F	Higher than 32° F
	Days	Days	Days
9 years in 10	195	177	153
8 years in 10	202	184	161
5 years in 10	215	197	174
2 years in 10	228	210	188
1 year in 10	235	217	195

TABLE 4.--ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS

Map symbol	Soil name	Acres	Percent
7B	Wiota silty clay loam, 1 to 5 percent slopes	1,140	0.3
11B	Colo-Ely silty clay loams, 2 to 5 percent slopes	1,090	0.3
24D2	Shelby loam, 9 to 14 percent slopes, moderately eroded	535	0.1
41C	Sparta loamy fine sand, 2 to 9 percent slopes	395	0.1
43	Bremer silty clay loam, 0 to 2 percent slopes	3,495	1.0
54	Zook silty clay loam, 0 to 2 percent slopes	2,410	0.7
58D2	Douds loam, 9 to 14 percent slopes, moderately eroded	205	0.1
58E2	Douds loam, 14 to 18 percent slopes, moderately eroded	210	0.1
65D	Lindley loam, 9 to 14 percent slopes	735	0.2
65D2	Lindley loam, 9 to 14 percent slopes, moderately eroded	2,120	0.6
65E	Lindley loam, 14 to 18 percent slopes	2,445	0.7
65E2	Lindley loam, 14 to 18 percent slopes, moderately eroded	3,810	1.0
65F	Lindley loam, 18 to 25 percent slopes	2,630	0.7
65F2	Lindley loam, 18 to 25 percent slopes, moderately eroded	550	0.2
65G	Lindley loam, 25 to 40 percent slopes	3,685	1.0
74	Rubio silt loam, 0 to 2 percent slopes	455	0.1
75	Givin silt loam, 0 to 2 percent slopes	5,335	1.5
76B	Ladoga silt loam, 2 to 5 percent slopes	9,925	2.7
76B2	Ladoga silt loam, 2 to 5 percent slopes, moderately eroded	1,675	0.5
76C	Ladoga silt loam, 5 to 9 percent slopes	655	0.2
76C2	Ladoga silt loam, 5 to 9 percent slopes, moderately eroded	9,580	2.6
76C3	Ladoga silty clay loam, 5 to 9 percent slopes, severely eroded	2,910	0.8
76D2	Ladoga silt loam, 9 to 14 percent slopes, moderately eroded	2,240	0.6
76D3	Ladoga silty clay loam, 9 to 14 percent slopes, severely eroded	1,365	0.4
80B	Clinton silt loam, 2 to 5 percent slopes	9,430	2.6
80C	Clinton silt loam, 5 to 9 percent slopes	2,385	0.7
80C2	Clinton silt loam, 5 to 9 percent slopes, moderately eroded	15,300	4.2
80C3	Clinton silty clay loam, 5 to 9 percent slopes, severely eroded	3,635	1.0
80D	Clinton silt loam, 9 to 14 percent slopes	2,585	0.7
80D2	Clinton silt loam, 9 to 14 percent slopes, moderately eroded	9,570	2.6
80D3	Clinton silty clay loam, 9 to 14 percent slopes, severely eroded	6,120	1.7
87B	Colo-Zook silty clay loams, 0 to 3 percent slopes	7,870	2.2
88	Nevin silty clay loam, 0 to 2 percent slopes	1,930	0.5
93D2	Shelby-Adair complex, 9 to 14 percent slopes, moderately eroded	1,760	0.5
93D3	Shelby-Adair clay loams, 9 to 14 percent slopes, severely eroded	990	0.3
122	Sperry silt loam, 0 to 2 percent slopes	600	0.2
133	Colo silty clay loam, 0 to 2 percent slopes	4,490	1.2
133+	Colo silt loam, overwash, 0 to 2 percent slopes	2,335	0.6
163E	Fayette silt loam, 14 to 18 percent slopes	875	0.2
163E2	Fayette silt loam, 14 to 18 percent slopes, moderately eroded	1,425	0.4
163E3	Fayette silty clay loam, 14 to 18 percent slopes, severely eroded	685	0.2
163F	Fayette silt loam, 18 to 25 percent slopes	1,065	0.3
163G	Fayette silt loam, 25 to 40 percent slopes	325	0.1
175	Dickinson sandy loam, 0 to 2 percent slopes	280	0.1
179D2	Gara loam, 9 to 14 percent slopes, moderately eroded	1,750	0.5
179E2	Gara loam, 14 to 18 percent slopes, moderately eroded	1,205	0.3
180	Keomah silt loam, 0 to 2 percent slopes	1,045	0.3
192C2	Adair silty clay loam, 5 to 9 percent slopes, moderately eroded	370	0.1
192D2	Adair silty clay loam, 9 to 14 percent slopes, moderately eroded	355	0.1
219	Jackson silt loam, 0 to 2 percent slopes	285	0.1
220	Nodaway silt loam, 0 to 2 percent slopes	7,220	2.0
222C2	Clarinda silty clay loam, 5 to 9 percent slopes, moderately eroded	1,620	0.4
222C3	Clarinda silty clay loam, 5 to 9 percent slopes, severely eroded	1,170	0.3
222D2	Clarinda silty clay loam, 9 to 14 percent slopes, moderately eroded	960	0.3
222D3	Clarinda silty clay loam, 9 to 14 percent slopes, severely eroded	385	0.1
223C2	Rinda silty clay loam, 5 to 9 percent slopes, moderately eroded	1,900	0.5
223D2	Rinda silty clay loam, 9 to 14 percent slopes, moderately eroded	2,290	0.6
263	Okaw silt loam, 0 to 2 percent slopes	290	0.1
264B	Ainsworth silt loam, 1 to 5 percent slopes	645	0.2
269	Humeston silty clay loam, 0 to 2 percent slopes	350	0.1
279	Taintor silty clay loam, 0 to 2 percent slopes	24,865	6.9
280	Mahaska silty clay loam, 0 to 2 percent slopes	29,875	8.3
281B	Otley silty clay loam, 2 to 5 percent slopes	18,530	5.1
281B2	Otley silty clay loam, 2 to 5 percent slopes, moderately eroded	1,470	0.4
281C	Otley silty clay loam, 5 to 9 percent slopes	725	0.2
281C2	Otley silty clay loam, 5 to 9 percent slopes, moderately eroded	11,090	3.1
281C3	Otley silty clay loam, 5 to 9 percent slopes, severely eroded	2,345	0.6

TABLE 4.--ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS--Continued

Map symbol	Soil name	Acres	Percent
281D2	Otley silty clay loam, 9 to 14 percent slopes, moderately eroded	505	0.1
281D3	Otley silty clay loam, 9 to 14 percent slopes, severely eroded	260	0.1
293E2	Fayette-Lamont-Chelsea complex, 14 to 25 percent slopes, moderately eroded	680	0.2
294C2	Ladoga-Billett complex, 5 to 9 percent slopes, moderately eroded	410	0.1
294D2	Ladoga-Billett complex, 9 to 14 percent slopes, moderately eroded	245	0.1
295C2	Clinton-Lamont-Chelsea complex, 5 to 9 percent slopes, moderately eroded	485	0.1
295D2	Clinton-Lamont-Chelsea complex, 9 to 14 percent slopes, moderately eroded	785	0.2
295D3	Clinton-Lamont-Chelsea complex, 9 to 14 percent slopes, severely eroded	355	0.1
422	Amana silt loam, 0 to 2 percent slopes	755	0.2
424D	Lindley-Keswick complex, 9 to 14 percent slopes	350	0.1
424D2	Lindley-Keswick complex, 9 to 14 percent slopes, moderately eroded	2,865	0.8
424D3	Lindley-Keswick clay loams, 9 to 14 percent slopes, severely eroded	1,155	0.3
424E2	Lindley-Keswick complex, 14 to 18 percent slopes, moderately eroded	1,580	0.4
425D2	Keswick silt loam, 9 to 14 percent slopes, moderately eroded	905	0.2
428B	Ely silty clay loam, 2 to 5 percent slopes	1,225	0.3
430	Ackmore silt loam, 0 to 2 percent slopes	1,245	0.3
453	Tuskeego silt loam, 0 to 2 percent slopes	4,130	1.1
484	Lawson silt loam, 0 to 2 percent slopes	4,475	1.2
499F	Nordness silt loam, 14 to 25 percent slopes	715	0.2
520	Coppock silt loam, 0 to 2 percent slopes	2,160	0.6
520B	Coppock silt loam, 2 to 5 percent slopes	1,740	0.5
539	Perks sandy loam, 0 to 3 percent slopes	120	*
570B	Nira silty clay loam, 2 to 5 percent slopes	13,050	3.6
570B2	Nira silty clay loam, 2 to 5 percent slopes, moderately eroded	3,460	1.0
570C2	Nira silty clay loam, 5 to 9 percent slopes, moderately eroded	4,425	1.2
570C3	Nira silty clay loam, 5 to 9 percent slopes, severely eroded	2,235	0.6
571B	Hedrick silt loam, 2 to 5 percent slopes	3,590	1.0
571B2	Hedrick silt loam, 2 to 5 percent slopes, moderately eroded	1,780	0.5
571C2	Hedrick silt loam, 5 to 9 percent slopes, moderately eroded	5,000	1.4
571C3	Hedrick silty clay loam, 5 to 9 percent slopes, severely eroded	3,085	0.8
572B	Inton silt loam, 2 to 5 percent slopes	495	0.1
572C2	Inton silt loam, 5 to 9 percent slopes, moderately eroded	2,670	0.7
592D2	Mystic loam, 9 to 14 percent slopes, moderately eroded	200	0.1
687B	Watkins silt loam, 1 to 5 percent slopes	1,875	0.5
688	Koszta silt loam, 0 to 2 percent slopes	1,605	0.4
715	Nodaway-Perks complex, 0 to 3 percent slopes	4,290	1.2
729B	Ackmore-Nodaway silt loams, 2 to 5 percent slopes	4,750	1.3
779	Kalona silty clay loam, 0 to 2 percent slopes	10,905	3.0
792C2	Armstrong silt loam, 5 to 9 percent slopes, moderately eroded	475	0.1
792D2	Armstrong silt loam, 9 to 14 percent slopes, moderately eroded	2,160	0.6
793B	Bertrand silt loam, 1 to 5 percent slopes	275	0.1
795D2	Ashgrove silt loam, 9 to 14 percent slopes, moderately eroded	1,110	0.3
876B	Ladoga silt loam, benches, 2 to 5 percent slopes	1,010	0.3
876C2	Ladoga silt loam, benches, 5 to 9 percent slopes, moderately eroded	1,310	0.4
880B	Clinton silt loam, benches, 2 to 5 percent slopes	1,410	0.4
880C2	Clinton silt loam, benches, 5 to 9 percent slopes, moderately eroded	1,705	0.5
880D2	Clinton silt loam, benches, 9 to 14 percent slopes, moderately eroded	310	0.1
881B	Otley silty clay loam, benches, 2 to 5 percent slopes	980	0.3
993D2	Gara-Armstrong complex, 9 to 14 percent slopes, moderately eroded	4,555	1.3
993D3	Gara-Armstrong clay loams, 9 to 14 percent slopes, severely eroded	1,880	0.5
993E2	Gara-Armstrong complex, 14 to 18 percent slopes, moderately eroded	490	0.1
994D3	Galland-Douds clay loams, 9 to 14 percent slopes, severely eroded	460	0.1
1075	Givin silt loam, benches, 1 to 3 percent slopes	330	0.1
1180	Keomah silt loam, benches, 1 to 3 percent slopes	410	0.1
1280	Mahaska silty clay loam, benches, 1 to 3 percent slopes	885	0.2
1354	Aquents, ponded	740	0.2
1484	Lawson silt loam, channeled, 0 to 2 percent slopes	505	0.1
2226	Elrin loam, 0 to 2 percent slopes	260	0.1
2242	Nodaway-Amana silt loams, 0 to 2 percent slopes	4,770	1.3
5030	Pits, quarries	345	0.1
5040	Orthents, loamy	240	0.1
	Water	2,355	0.6
	Total	363,520	100.0

* Less than 0.1 percent.

TABLE 5.--PRIME FARMLAND

[Only the soils considered prime farmland are listed. Urban or built-up areas of the soils listed are not considered prime farmland. If a soil is prime farmland only under certain conditions, the conditions are specified in parentheses after the soil name]

Map symbol	Soil name
7B	Wiota silty clay loam, 1 to 5 percent slopes
11B	Colo-Ely silty clay loams, 2 to 5 percent slopes (where drained)
43	Bremer silty clay loam, 0 to 2 percent slopes (where drained)
54	Zook silty clay loam, 0 to 2 percent slopes (where drained)
74	Rubio silt loam, 0 to 2 percent slopes (where drained)
75	Givin silt loam, 0 to 2 percent slopes (where drained)
76B	Ladoga silt loam, 2 to 5 percent slopes
76B2	Ladoga silt loam, 2 to 5 percent slopes, moderately eroded
80B	Clinton silt loam, 2 to 5 percent slopes
87B	Colo-Zook silty clay loams, 0 to 3 percent slopes (where drained)
88	Nevin silty clay loam, 0 to 2 percent slopes
122	Sperry silt loam, 0 to 2 percent slopes (where drained)
133	Colo silty clay loam, 0 to 2 percent slopes (where drained)
133+	Colo silt loam, overwash, 0 to 2 percent slopes (where drained)
175	Dickinson sandy loam, 0 to 2 percent slopes
180	Keomah silt loam, 0 to 2 percent slopes (where drained)
219	Jackson silt loam, 0 to 2 percent slopes
220	Nodaway silt loam, 0 to 2 percent slopes
263	Okaw silt loam, 0 to 2 percent slopes (where drained)
264B	Ainsworth silt loam, 1 to 5 percent slopes
269	Humeston silty clay loam, 0 to 2 percent slopes (where drained)
279	Taintor silty clay loam, 0 to 2 percent slopes (where drained)
280	Mahaska silty clay loam, 0 to 2 percent slopes
281B	Otley silty clay loam, 2 to 5 percent slopes
281B2	Otley silty clay loam, 2 to 5 percent slopes, moderately eroded
422	Amana silt loam, 0 to 2 percent slopes
428B	Ely silty clay loam, 2 to 5 percent slopes
430	Ackmore silt loam, 0 to 2 percent slopes (where drained)
453	Tuskeego silt loam, 0 to 2 percent slopes (where drained)
484	Lawson silt loam, 0 to 2 percent slopes
520	Coppock silt loam, 0 to 2 percent slopes (where drained)
520B	Coppock silt loam, 2 to 5 percent slopes (where drained)
570B	Nira silty clay loam, 2 to 5 percent slopes
570B2	Nira silty clay loam, 2 to 5 percent slopes, moderately eroded
571B	Hedrick silt loam, 2 to 5 percent slopes
571B2	Hedrick silt loam, 2 to 5 percent slopes, moderately eroded
572B	Inton silt loam, 2 to 5 percent slopes
687B	Watkins silt loam, 1 to 5 percent slopes
688	Koszta silt loam, 0 to 2 percent slopes (where drained)
729B	Ackmore-Nodaway silt loams, 2 to 5 percent slopes (where drained)
779	Kalona silty clay loam, 0 to 2 percent slopes (where drained)
793B	Bertrand silt loam, 1 to 5 percent slopes
876B	Ladoga silt loam, benches, 2 to 5 percent slopes
880B	Clinton silt loam, benches, 2 to 5 percent slopes
881B	Otley silty clay loam, benches, 2 to 5 percent slopes
1075	Givin silt loam, benches, 1 to 3 percent slopes (where drained)
1180	Keomah silt loam, benches, 1 to 3 percent slopes (where drained)
1280	Mahaska silty clay loam, benches, 1 to 3 percent slopes
2226	Elrin loam, 0 to 2 percent slopes
2242	Nodaway-Amana silt loams, 0 to 2 percent slopes (where protected from flooding or not frequently flooded during the growing season)

TABLE 6.--LAND CAPABILITY CLASSES AND YIELDS PER ACRE OF CROPS AND PASTURE

[Yields are those that can be expected under a high level of management. Absence of a yield indicates that the soil is not suited to the crop or the crop generally is not grown on the soil]

Soil name and map symbol	Land capability	Corn	Soybeans	Oats	Grass-legume hay	Kentucky bluegrass	Smooth bromegrass	Bromegrass-alfalfa
		Bu	Bu	Bu	Tons	AUM*	AUM*	AUM*
7B-------------- Wiota	IIe	160	54	96	6.7	4.0	6.4	7.5
11B-------------- Colo-Ely	IIw	138	46	76	4.1	4.1	6.0	7.4
24D2------------ Shelby	IIIe	115	39	58	4.8	3.3	4.9	5.6
41C-------------- Sparta	IVs	72	23	43	3.0	1.0	2.5	3.9
43--------------- Bremer	IIw	139	47	83	4.2	4.0	6.3	7.5
54--------------- Zook	IIw	126	42	76	3.8	4.0	4.0	4.8
58D2------------ Douds	IVe	72	24	36	3.0	1.9	2.7	4.3
58E2------------ Douds	VIe	---	---	26	2.2	1.5	3.0	2.8
65D-------------- Lindley	IVe	101	34	51	4.2	3.3	6.0	7.0
65D2------------ Lindley	IVe	97	32	49	4.1	3.2	5.8	6.8
65E-------------- Lindley	VIe	---	---	---	3.5	2.7	4.0	5.2
65E2------------ Lindley	VIe	---	---	---	3.4	2.5	3.0	4.1
65F-------------- Lindley	VIIe	---	---	---	---	1.6	2.0	3.0
65F2------------ Lindley	VIIe	---	---	---	---	1.4	1.5	2.4
65G-------------- Lindley	VIIe	---	---	---	---	1.2	1.6	2.0
74--------------- Rubio	IIIw	138	46	76	4.1	3.8	5.7	6.6
75--------------- Givin	I	148	50	81	5.9	4.2	8.3	8.3
76B-------------- Ladoga	IIe	148	50	81	6.2	4.3	6.8	7.8
76B2------------ Ladoga	IIe	144	48	79	6.0	4.2	6.6	7.6
76C-------------- Ladoga	IIIe	143	48	79	6.0	4.0	6.5	7.5

See footnotes at end of table.

TABLE 6.--LAND CAPABILITY CLASSES AND YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Land capability	Corn	Soybeans	Oats	Grass-legume hay	Kentucky bluegrass	Smooth bromegrass	Bromegrass-alfalfa
		Bu	Bu	Bu	Tons	AUM*	AUM*	AUM*
76C2------------ Ladoga	IIIe	139	47	76	5.8	3.9	6.3	7.3
76C3------------ Ladoga	IVe	131	44	72	5.5	3.8	5.8	6.9
76D2------------ Ladoga	IIIe	130	44	72	5.5	3.7	5.7	6.6
76D3------------ Ladoga	IVe	122	41	67	5.1	3.8	5.9	7.0
80B------------- Clinton	IIe	139	47	76	5.8	4.0	6.4	7.5
80C------------- Clinton	IIIe	134	45	74	5.6	3.8	6.1	7.1
80C2------------ Clinton	IIIe	130	44	72	5.5	3.6	6.0	7.0
80C3------------ Clinton	IVe	122	41	67	5.1	3.8	6.1	7.1
80D------------- Clinton	IIIe	125	42	69	5.2	3.6	5.6	6.5
80D2------------ Clinton	IIIe	121	41	67	5.1	3.5	5.3	6.3
80D3------------ Clinton	IVe	113	38	62	4.8	2.8	5.0	6.0
87B------------- Colo-Zook	IIw	124	42	68	3.7	4.2	5.0	5.8
88-------------- Nevin	I	163	55	98	6.5	4.0	8.0	8.0
93D2------------ Shelby-Adair	IVe	100	34	50	4.1	2.7	4.1	4.9
93D3------------ Shelby-Adair	VIe	---	---	---	3.7	2.2	3.5	4.2
122------------- Sperry	IIIw	124	42	68	3.7	3.6	5.1	5.2
133------------- Colo	IIw	136	46	82	4.2	4.2	5.5	7.0
133+------------ Colo	IIw	140	47	92	4.3	4.2	5.8	7.0
163E------------ Fayette	IVe	118	40	71	5.0	3.0	4.2	5.0
163E2----------- Fayette	IVe	114	38	68	4.8	3.2	4.8	5.6
163E3----------- Fayette	VIe	---	---	64	4.4	3.0	4.5	5.3

See footnotes at end of table.

TABLE 6.--LAND CAPABILITY CLASSES AND YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Land capability	Corn	Soybeans	Oats	Grass-legume hay	Kentucky bluegrass	Smooth bromegrass	Bromegrass-alfalfa
		Bu	Bu	Bu	Tons	AUM*	AUM*	AUM*
163F------------ Fayette	VIe	---	---	63	4.6	3.1	4.8	5.6
163G------------ Fayette	VIIe	---	---	---	4.2	3.0	4.2	5.0
175------------- Dickinson	IIs	112	34	67	4.7	2.7	5.0	5.0
179D2----------- Gara	IVe	106	36	53	4.5	2.5	4.5	5.1
179E2----------- Gara	VIe	---	---	---	3.7	1.5	3.2	3.8
180------------- Keomah	IIw	131	44	72	5.2	4.3	8.0	8.0
192C2----------- Adair	IIIe	85	28	43	3.4	2.3	3.5	4.5
192D2----------- Adair	IVe	76	25	38	3.0	1.9	2.9	3.8
219------------- Jackson	I	140	47	84	5.9	4.3	7.8	8.0
220------------- Nodaway	IIw	153	51	92	6.4	4.0	6.5	7.6
222C2----------- Clarinda	IVw	72	24	36	2.2	2.3	3.3	3.6
222C3----------- Clarinda	VIe	---	---	---	1.6	1.5	2.8	2.5
222D2----------- Clarinda	IVe	66	22	33	2.0	1.7	2.9	3.0
222D3----------- Clarinda	VIe	---	---	---	1.3	1.3	2.5	2.3
223C2----------- Rinda	IVw	63	21	32	1.9	2.3	3.3	3.5
223D2----------- Rinda	IVe	57	19	29	1.7	1.7	2.5	2.8
263------------- Okaw	IIIw	98	33	49	2.9	2.5	3.4	3.6
264B------------ Ainsworth	IIe	127	43	70	5.3	3.1	6.0	6.9
269------------- Humeston	IIIw	110	37	55	3.3	3.3	5.0	6.1
279------------- Taintor	IIw	155	52	85	4.7	4.2	7.0	7.8
280------------- Mahaska	I	165	55	91	6.6	4.5	7.5	8.6

See footnotes at end of table.

TABLE 6.--LAND CAPABILITY CLASSES AND YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Land capability	Corn	Soybeans	Oats	Grass-legume hay	Kentucky bluegrass	Smooth bromegrass	Bromegrass-alfalfa
		Bu	Bu	Bu	Tons	AUM*	AUM*	AUM*
281B------------ Otley	IIe	157	53	86	6.6	4.3	7.1	8.3
281B2----------- Otley	IIe	153	51	84	6.4	4.2	6.9	8.1
281C------------ Otley	IIIe	152	51	84	6.4	4.0	6.8	8.0
281C2----------- Otley	IIIe	148	50	81	6.2	3.9	6.6	7.8
281C3----------- Otley	IVe	140	47	77	5.9	3.8	6.2	7.2
281D2----------- Otley	IIIe	139	47	76	5.8	3.7	6.1	7.1
281D3----------- Otley	IVe	131	44	72	5.5	3.6	5.7	6.6
293E2----------- Fayette-Lamont-Chelsea	VIe	---	---	---	2.1	1.8	2.8	3.1
294C2----------- Ladoga-Billett	IIIe	121	41	69	5.1	3.4	4.7	6.8
294D2----------- Ladoga-Billett	IVe	114	38	65	4.8	3.1	4.3	6.2
295C2----------- Clinton-Lamont-Chelsea	IIIe	98	32	57	3.8	2.7	4.4	5.1
295D2----------- Clinton-Lamont-Chelsea	IVe	86	29	51	3.2	2.3	3.6	4.2
295D3----------- Clinton-Lamont-Chelsea	IVe	79	26	48	2.9	1.9	3.3	3.7
422------------- Amana	IIw	145	49	87	5.8	4.1	6.6	7.6
424D------------ Lindley-Keswick	IVe	89	30	49	3.4	2.5	4.2	5.0
424D2----------- Lindley-Keswick	IVe	82	27	45	3.3	2.2	3.4	4.0
424D3----------- Lindley-Keswick	VIe	---	---	---	2.8	1.9	2.8	3.4
424E2----------- Lindley-Keswick	VIe	---	---	---	2.1	1.5	2.4	3.0
425D2----------- Keswick	IVe	62	21	31	2.6	1.3	2.7	3.0
428B------------ Ely	IIe	159	53	95	5.3	4.0	7.5	8.8

See footnotes at end of table.

TABLE 6.--LAND CAPABILITY CLASSES AND YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Land capability	Corn	Soybeans	Oats	Grass-legume hay	Kentucky bluegrass	Smooth bromegrass	Bromegrass-alfalfa
		Bu	Bu	Bu	Tons	AUM*	AUM*	AUM*
430------------- Ackmore	IIw	141	47	85	4.2	3.8	6.3	7.5
453------------- Tuskeego	IIIw	115	39	63	3.5	3.3	4.3	5.5
484------------- Lawson	IIw	157	53	94	6.3	4.6	7.0	7.6
499F------------ Nordness	VIIs	---	---	---	---	0.7	0.8	0.8
520------------- Coppock	IIw	121	41	61	3.6	3.3	4.7	6.1
520B------------ Coppock	IIw	118	40	59	3.5	3.3	4.3	6.0
539------------- Perks	IVs	60	20	33	2.5	1.9	2.4	3.9
570B------------ Nira	IIe	152	51	84	6.4	4.5	6.8	8.0
570B2----------- Nira	IIe	148	50	81	6.2	4.3	6.6	7.8
570C2----------- Nira	IIIe	143	48	79	6.0	3.9	6.3	7.5
570C3----------- Nira	IVe	135	45	74	5.7	3.7	5.9	7.0
571B------------ Hedrick	IIe	137	46	75	5.8	4.0	6.6	7.6
571B2----------- Hedrick	IIe	133	45	73	5.6	3.9	6.4	7.5
571C2----------- Hedrick	IIIe	128	43	70	5.4	3.6	6.1	7.0
571C3----------- Hedrick	IVe	120	40	66	5.0	3.6	5.8	6.9
572B------------ Inton	IIe	134	45	74	5.6	3.7	5.9	7.0
572C2----------- Inton	IIIe	125	42	69	5.2	3.3	5.5	6.5
592D2----------- Mystic	IVe	59	20	30	2.3	1.9	2.3	3.3
687B------------ Watkins	IIe	151	51	91	6.3	3.7	6.1	7.1
688------------- Koszta	I	154	52	92	6.2	3.7	6.5	7.5
715------------- Nodaway-Perks	Vw	---	---	---	---	1.5	2.2	3.3

See footnotes at end of table.

TABLE 6.--LAND CAPABILITY CLASSES AND YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Land capability	Corn	Soybeans	Oats	Grass-legume hay	Kentucky bluegrass	Smooth bromegrass	Bromegrass-alfalfa
		Bu	Bu	Bu	Tons	AUM*	AUM*	AUM*
729B------------ Ackmore-Nodaway	IIw	137	46	75	4.1	3.8	5.7	6.6
779------------- Kalona	IIw	152	51	84	4.6	4.2	7.8	7.8
792C2----------- Armstrong	IIIe	73	24	37	2.9	2.1	3.1	4.1
792D2----------- Armstrong	IVe	67	22	34	2.7	1.7	2.7	3.3
793B------------ Bertrand	IIe	141	47	85	5.9	3.4	5.8	6.5
795D2----------- Ashgrove	IVe	48	16	24	1.4	1.5	1.7	3.0
876B------------ Ladoga	IIe	148	50	81	6.2	4.3	6.8	7.8
876C2----------- Ladoga	IIIe	139	47	76	5.8	3.9	6.3	7.3
880B------------ Clinton	IIe	139	47	76	5.8	4.0	6.4	7.5
880C2----------- Clinton	IIIe	130	44	72	5.5	3.6	6.0	7.0
880D2----------- Clinton	IIIe	121	41	67	5.1	3.5	5.3	6.3
881B------------ Otley	IIe	157	53	86	6.6	4.3	7.1	8.3
993D2----------- Gara-Armstrong	IVe	91	31	45	3.8	2.2	3.8	4.4
993D3----------- Gara-Armstrong	VIe	---	---	---	3.2	1.1	1.2	1.9
993E2----------- Gara-Armstrong	VIe	---	---	---	3.0	1.4	2.4	3.2
994D3----------- Galland-Douds	VIe	---	---	---	1.6	1.3	2.3	2.3
1075------------ Givin	IIe	145	49	80	5.8	4.2	8.1	8.1
1180------------ Keomah	IIe	128	43	70	5.1	4.1	7.8	7.8
1280------------ Mahaska	IIe	162	54	89	6.5	4.2	7.1	8.3
1354**---------- Aquents	Vw	---	---	---	---	---	---	---
1484------------ Lawson	Vw	---	---	---	---	3.0	---	---

See footnotes at end of table.

TABLE 6.--LAND CAPABILITY CLASSES AND YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Land capability	Corn	Soybeans	Oats	Grass-legume hay	Kentucky bluegrass	Smooth bromegrass	Bromegrass-alfalfa
		Bu	Bu	Bu	Tons	AUM*	AUM*	AUM*
2226------------ Elrin	IIs	140	47	77	5.6	4.1	6.1	7.1
2242------------ Nodaway-Amana	IIIw	118	39	65	4.7	3.9	5.9	6.8
5030**. Pits								
5040**. Orthents								

* Animal-unit-month: The amount of forage or feed required to feed one animal unit (one cow, one horse, one mule, five sheep, or five goats) for 30 days.

** See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 7.--WOODLAND MANAGEMENT AND PRODUCTIVITY

[Only the soils suitable for production of commercial trees are listed. Absence of an entry indicates that information was not available]

Soil name and map symbol	Ordination symbol	Management concerns: Erosion hazard	Management concerns: Equipment limitation	Management concerns: Seedling mortality	Management concerns: Windthrow hazard	Potential productivity: Common trees	Potential productivity: Site index	Trees to plant
41C Sparta	6s	Slight	Slight	Severe	Slight	Jack pine	57	Red pine, eastern white pine, jack pine.
						Northern red oak	47	
						Red pine	---	
58D2 Douds	3a	Slight	Slight	Slight	Slight	White oak	55	Eastern white pine, red pine, European larch, sugar maple.
						Northern red oak	55	
58E2 Douds	3r	Moderate	Moderate	Slight	Slight	White oak	55	Eastern white pine, red pine, European larch, sugar maple.
						Northern red oak	55	
65D Lindley	3a	Slight	Slight	Slight	Slight	White oak	60	White oak, green ash, yellow-poplar, northern red oak, black oak.
						Post oak	---	
						Blackjack oak	---	
						Black oak	---	
						White oak	---	
						Post oak	---	
65D2 Lindley	2a	Slight	Slight	Slight	Slight	Blackjack oak	50	White oak, green ash, yellow-poplar, black oak.
						Black oak	---	
65E Lindley	3r	Severe	Severe	Slight	Slight	White oak	60	White oak, green ash, yellow-poplar, northern red oak, black oak.
						Post oak	---	
						Blackjack oak	---	
						Black oak	---	
						White oak	---	
						Post oak	---	
65E2 Lindley	2r	Moderate	Moderate	Moderate	Slight	Blackjack oak	50	White oak, green ash, yellow-poplar, black oak.
						Black oak	---	
65F Lindley	3r	Moderate	Moderate	Slight	Slight	White oak	60	White oak, green ash, yellow-poplar, northern red oak, black oak.
						Post oak	---	
						Blackjack oak	---	
						Black oak	---	
						White oak	---	
						Post oak	---	
65F2 Lindley	2r	Moderate	Moderate	Moderate	Slight	Blackjack oak	50	White oak, green ash, yellow-poplar, black oak.
						Black oak	---	
65G Lindley	3r	Moderate	Moderate	Slight	Slight	White oak	60	White oak, green ash, yellow-poplar, northern red oak, black oak.
						Post oak	---	
						Blackjack oak	---	
						Black oak	---	
						White oak	---	
						Post oak	---	
74 Rubio	2w	Slight	Severe	Moderate	Moderate	White oak	45	Eastern cottonwood, silver maple, American sycamore, green ash.

TABLE 7.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns: Erosion hazard	Management concerns: Equipment limitation	Management concerns: Seedling mortality	Management concerns: Windthrow hazard	Potential productivity: Common trees	Potential productivity: Site index	Trees to plant
75----------------- Givin	3a	Slight	Slight	Slight	Slight	White oak-----------	65	Eastern white pine, red pine, black walnut, sugar maple, white oak, northern red oak.
						Northern red oak----	---	
76B, 76B2, 76C, 76C2, 76C3, 76D2, 76D3-------------- Ladoga	4a	Slight	Slight	Slight	Slight	White oak-----------	75	Eastern white pine, red pine, white oak, sugar maple, northern red oak, European larch, black walnut.
						Northern red oak----	75	
80B, 80C, 80C2, 80C3, 80D, 80D2, 80D3-------------- Clinton	3a	Slight	Slight	Slight	Slight	White oak-----------	65	Eastern white pine, red pine, black walnut, white oak, European larch, northern red oak.
						Northern red oak----	65	
163E--------------- Fayette	4r	Severe	Severe	Slight	Slight	White oak-----------	80	Eastern white pine, northern red oak, green ash, yellow-poplar.
						Northern red oak----	80	
						Yellow-poplar-------	90	
						Black walnut--------	---	
163E2, 163E3, 163F, 163G-------------- Fayette	4r	Moderate	Moderate	Slight	Slight	White oak-----------	80	Eastern white pine, northern red oak, green ash, yellow-poplar.
						Northern red oak----	80	
						Yellow-poplar-------	90	
						Black walnut--------	---	
179D2-------------- Gara	3a	Slight	Slight	Slight	Slight	White oak-----------	55	Eastern white pine, red pine, white oak, northern red oak.
						Northern red oak----	55	
179E2-------------- Gara	3r	Moderate	Moderate	Slight	Slight	White oak-----------	55	Eastern white pine, red pine, white oak, northern red oak.
						Northern red oak----	55	
180---------------- Keomah	3a	Slight	Slight	Slight	Slight	White oak-----------	65	Eastern white pine, white oak, red pine, northern red oak, black walnut, sugar maple.
						Northern red oak----	70	
219---------------- Jackson	4a	Slight	Slight	Slight	Slight	Northern red oak----	70	Red pine, eastern white pine, white spruce, black walnut.
						White ash-----------	---	
						White oak-----------	---	
						Bur oak-------------	---	
						Black walnut--------	---	
220---------------- Nodaway	3a	Slight	Slight	Slight	Slight	White oak-----------	65	Eastern white pine, red pine, black walnut, sugar maple, European larch.
223C2, 223D2------- Rinda	2w	Slight	Severe	Moderate	Moderate	White oak-----------	45	Silver maple, American sycamore, green ash, hackberry.
						Northern red oak----	45	

TABLE 7.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordi-nation symbol	Management concerns: Erosion hazard	Management concerns: Equip-ment limita-tion	Management concerns: Seedling mortal-ity	Management concerns: Wind-throw hazard	Potential productivity: Common trees	Potential productivity: Site index	Trees to plant
263---------------- Okaw	4w	Slight	Severe	Severe	Severe	Pin oak------------ Blackjack oak------- Black oak----------- White oak-----------	70 60 55 ---	Pin oak, green ash, red maple, swamp white oak.
264B--------------- Ainsworth	7a	Slight	Slight	Slight	Slight	Green ash----------- Silver maple--------	80 ---	Eastern white pine, red pine, Norway spruce, European larch, white spruce, sugar maple, northern red oak, white oak.
293E2*:								
Fayette-----------	4r	Moderate	Moderate	Slight	Slight	White oak----------- Northern red oak---- Yellow-poplar------- Black walnut--------	80 80 90 ---	Eastern white pine, northern red oak, green ash, yellow-poplar.
Lamont------------	3r	Moderate	Moderate	Slight	Slight	Northern red oak---- White oak-----------	55 55	Eastern white pine.
Chelsea-----------	3r	Moderate	Severe	Moderate	Slight	White oak-----------	55	Eastern white pine, Scotch pine, European larch, eastern redcedar, red pine, jack pine.
294C2*, 294D2*:								
Ladoga------------	4a	Slight	Slight	Slight	Slight	White oak----------- Northern red oak----	75 75	Eastern white pine, red pine, white oak, sugar maple, northern red oak, European larch, black walnut.
Billett-----------	4a	Slight	Slight	Slight	Slight	Black oak----------- White oak----------- Scarlet oak---------	70 70 70	Eastern white pine, Scotch pine, eastern redcedar, red pine.
295C2*, 295D2*, 295D3*:								
Clinton----------	3a	Slight	Slight	Slight	Slight	White oak----------- Northern red oak----	65 65	Eastern white pine, red pine, black walnut, white oak, European larch, northern red oak.
Lamont-----------	3a	Slight	Slight	Slight	Slight	Northern red oak---- White oak-----------	55 55	Eastern white pine.
Chelsea----------	3s	Slight	Slight	Moderate	Slight	White oak-----------	55	Eastern white pine, red pine, jack pine.
422---------------- Amana	3a	Slight	Slight	Slight	Slight	White oak----------- Northern red oak----	62 58	Eastern white pine, red pine.
424D*:								
Lindley-----------	3a	Slight	Slight	Slight	Slight	White oak----------- Post oak------------ Blackjack oak------- Black oak----------- White oak----------- Post oak------------	60 --- --- --- --- ---	White oak, green ash, yellow-poplar, northern red oak, black oak.

See footnote at end of table.

TABLE 7.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns: Erosion hazard	Management concerns: Equipment limitation	Management concerns: Seedling mortality	Management concerns: Windthrow hazard	Potential productivity: Common trees	Potential productivity: Site index	Trees to plant
424D*:								
Keswick-----------	3c	Slight	Slight	Slight	Moderate	White oak----------- Northern red oak----	55 55	Eastern white pine, red pine, sugar maple.
424D2*:								
Lindley-----------	2a	Slight	Slight	Slight	Slight	Blackjack oak------- Black oak-----------	50 ---	White oak, green ash, yellow-poplar, black oak.
Keswick-----------	3c	Slight	Slight	Slight	Moderate	White oak----------- Northern red oak----	55 55	Eastern white pine, red pine, sugar maple.
424D3*:								
Lindley-----------	3a	Slight	Slight	Slight	Slight	White oak----------- Post oak------------ Blackjack oak------- Black oak----------- White oak----------- Post oak------------	60 --- --- --- --- ---	White oak, green ash, yellow-poplar, northern red oak, black oak.
Keswick-----------	3c	Slight	Slight	Slight	Moderate	White oak----------- Northern red oak----	55 55	Eastern white pine, red pine, sugar maple.
424E2*:								
Lindley-----------	2r	Moderate	Moderate	Moderate	Slight	Blackjack oak------- Black oak-----------	50 ---	White oak, green ash, yellow-poplar, black oak.
Keswick-----------	3r	Moderate	Moderate	Slight	Moderate	White oak----------- Northern red oak----	55 55	Eastern white pine, red pine, sugar maple.
425D2-------------- Keswick	3c	Slight	Slight	Slight	Moderate	White oak----------- Northern red oak----	55 55	Eastern white pine, red pine, sugar maple.
430---------------- Ackmore	3a	Slight	Slight	Slight	Slight	White oak-----------	65	Eastern white pine, red pine, cottonwood, sugar maple, black walnut.
453---------------- Tuskeego	3w	Slight	Severe	Moderate	Moderate	Eastern cottonwood-- Silver maple--------	90 80	Eastern cottonwood, silver maple, American sycamore, green ash.
499F--------------- Nordness	2r	Moderate	Moderate	Severe	Severe	Northern red oak---- White oak-----------	45 45	
520, 520B---------- Coppock	3a	Slight	Slight	Slight	Slight	White oak----------- Northern red oak----	65 65	Eastern white pine, red pine, sugar maple.
539---------------- Perks	3s	Slight	Slight	Moderate	Slight	White oak-----------	55	Eastern white pine.
571B, 571B2, 571C2, 571C3------------- Hedrick	4a	Slight	Slight	Slight	Slight	White oak-----------	75	Eastern white pine, red pine, sugar maple.

See footnote at end of table.

TABLE 7.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns: Erosion hazard	Equipment limitation	Seedling mortality	Windthrow hazard	Potential productivity: Common trees	Site index	Trees to plant
572B, 572C2 Inton	3a	Slight	Slight	Slight	Slight	White oak Northern red oak	65 65	Eastern white pine, red pine, black walnut, sugar maple, black walnut.
592D2 Mystic	3a	Slight	Slight	Slight	Slight	White oak Northern red oak	55 55	Eastern white pine, red pine, black walnut, sugar maple.
687B Watkins	4a	Slight	Slight	Slight	Slight	White oak	70	Eastern white pine, red pine, sugar maple.
688 Koszta	3a	Slight	Slight	Slight	Slight	White oak Northern red oak	65 70	Eastern white pine, red pine, white oak, northern red oak, sugar maple.
715*:								
Nodaway	3a	Slight	Slight	Slight	Slight	White oak	65	Eastern white pine, red pine, black walnut, sugar maple.
Perks	3s	Slight	Slight	Moderate	Slight	White oak	55	Eastern white pine.
729B*:								
Ackmore	3a	Slight	Slight	Slight	Slight	White oak	65	Eastern white pine, red pine, cottonwood, sugar maple, black walnut.
Nodaway	3a	Slight	Slight	Slight	Slight	White oak	65	Eastern white pine, red pine, black walnut, sugar maple, European larch.
792C2, 792D2 Armstrong	3c	Slight	Slight	Severe	Severe	White oak Northern red oak	55 55	Eastern white pine, red pine, European larch, sugar maple.
793B Bertrand	4a	Slight	Slight	Slight	Slight	Northern red oak White ash White oak Bur oak Black walnut	70 --- --- --- ---	Red pine, eastern white pine, black walnut.
795D2 Ashgrove	2w	Slight	Severe	Moderate	Moderate	White oak Northern red oak	45 45	Silver maple, American sycamore, green ash, hackberry.
876B, 876C2 Ladoga	4a	Slight	Slight	Slight	Slight	White oak Northern red oak	75 75	Eastern white pine, red pine, white oak, sugar maple, northern red oak, European larch, black walnut.
880B, 880C2, 880D2 Clinton	3a	Slight	Slight	Slight	Slight	White oak Northern red oak	65 65	Eastern white pine, red pine, black walnut, white oak, European larch, northern red oak.

See footnote at end of table.

TABLE 7.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordi- nation symbol	Management concerns				Potential productivity		Trees to plant
		Erosion hazard	Equip- ment limita- tion	Seedling mortal- ity	Wind- throw hazard	Common trees	Site index	
993D2*, 993D3*:								
Gara	3a	Slight	Slight	Slight	Slight	White oak Northern red oak	55 55	Eastern white pine, red pine, white oak, northern red oak.
Armstrong	3c	Slight	Slight	Severe	Severe	White oak Northern red oak	55 55	Eastern white pine, red pine, European larch, sugar maple.
993E2*:								
Gara	3r	Moderate	Moderate	Slight	Slight	White oak Northern red oak	55 55	Eastern white pine, red pine, white oak, northern red oak.
Armstrong	3r	Moderate	Moderate	Severe	Severe	White oak Northern red oak	55 55	Eastern white pine, red pine, European larch, sugar maple.
994D3*:								
Galland	3c	Slight	Slight	Severe	Severe	White oak Northern red oak	65 70	Eastern white pine, red pine, black walnut, sugar maple.
Douds	3a	Slight	Slight	Slight	Slight	White oak Northern red oak	55 55	Eastern white pine, red pine, sugar maple.
1075 Givin	3a	Slight	Slight	Slight	Slight	White oak Northern red oak	65 ---	Eastern white pine, red pine, black walnut, sugar maple, white oak, northern red oak.
1180 Keomah	3a	Slight	Slight	Slight	Slight	White oak Northern red oak	65 70	Eastern white pine, white oak, red pine, northern red oak, black walnut, sugar maple.
2242*:								
Nodaway	3a	Slight	Slight	Slight	Slight	White oak	65	Eastern white pine, red pine, black walnut, sugar maple, European larch.
Amana	3a	Slight	Slight	Slight	Slight	White oak Northern red oak	62 58	Eastern white pine, red pine.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 8.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS

[The symbol < means less than; > means more than. Absence of an entry indicates that trees generally do not grow to the given height on that soil]

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
7B Wiota	---	Silky dogwood, Amur privet, Amur honeysuckle, American cranberrybush.	White fir, blue spruce, northern white-cedar, Washington hawthorn.	Austrian pine, Norway spruce.	Eastern white pine, pin oak.
11B*:					
Colo	---	Amur privet, Amur honeysuckle, American cranberrybush, silky dogwood.	Norway spruce, Austrian pine, white fir, blue spruce, Washington hawthorn, northern white-cedar.	Eastern white pine	Pin oak.
Ely	---	Amur privet, Amur honeysuckle, American cranberrybush, silky dogwood.	Austrian pine, white fir, blue spruce, northern white-cedar, Washington hawthorn.	Norway spruce	Eastern white pine, pin oak.
24D2 Shelby	---	Silky dogwood, American cranberrybush, Amur honeysuckle, Amur privet.	Washington hawthorn, northern white-cedar, blue spruce, white fir.	Norway spruce, Austrian pine.	Pin oak, eastern white pine.
41C Sparta	American hazel	Tamarisk	Austrian pine	Red pine	---
43 Bremer	---	Silky dogwood, Amur privet, Amur honeysuckle, American cranberrybush.	Norway spruce, Austrian pine, blue spruce, white fir, northern white-cedar, Washington hawthorn.	Eastern white pine	Pin oak.
54 Zook	---	Silky dogwood, Amur honeysuckle, American cranberrybush, Amur privet.	Norway spruce, northern white-cedar, Austrian pine, blue spruce, white fir, Washington hawthorn.	Eastern white pine	Pin oak.
58D2, 58E2 Douds	---	Silky dogwood, Amur privet, American cranberrybush, Amur honeysuckle.	Blue spruce, white fir, northern white-cedar, Washington hawthorn.	Austrian pine, Norway spruce.	Eastern white pine, pin oak.
65D, 65D2, 65E, 65E2, 65F, 65F2, 65G. Lindley					

See footnote at end of table.

TABLE 8.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
74 Rubio	---	Amur privet, silky dogwood, Amur honeysuckle, American cranberrybush.	Austrian pine, northern white-cedar, Washington hawthorn, Norway spruce, blue spruce, white fir.	Eastern white pine	Pin oak.
75 Givin	---	American cranberrybush, Amur honeysuckle, Amur privet, silky dogwood.	Austrian pine, white fir, blue spruce, northern white-cedar, Washington hawthorn.	Norway spruce	Pin oak, eastern white pine.
76B, 76B2, 76C, 76C2, 76C3, 76D2, 76D3 Ladoga	---	Silky dogwood, Amur privet, Amur honeysuckle, American cranberrybush.	White fir, blue spruce, northern white-cedar, Washington hawthorn.	Austrian pine, Norway spruce.	Eastern white pine, pin oak.
80B, 80C, 80C2, 80C3, 80D, 80D2, 80D3 Clinton	---	Amur privet, Amur honeysuckle, American cranberrybush, silky dogwood.	White fir, blue spruce, northern white-cedar, Washington hawthorn.	Norway spruce, Austrian pine.	Eastern white pine, pin oak.
87B*:					
Colo	---	Amur privet, Amur honeysuckle, American cranberrybush, silky dogwood.	Norway spruce, Austrian pine, white fir, blue spruce, Washington hawthorn, northern white-cedar.	Eastern white pine	Pin oak.
Zook	---	Silky dogwood, American cranberrybush, Amur honeysuckle, Amur privet.	Washington hawthorn, white fir, blue spruce, northern white-cedar, Austrian pine, Norway spruce.	Eastern white pine	Pin oak.
88 Nevin	---	Silky dogwood, Amur privet, American cranberrybush, Amur honeysuckle.	Austrian pine, white fir, blue spruce, northern white-cedar, Washington hawthorn.	Norway spruce	Eastern white pine, pin oak.
93D2*, 93D3*:					
Shelby	---	Silky dogwood, American cranberrybush, Amur honeysuckle, Amur privet.	Washington hawthorn, northern white-cedar, blue spruce, white fir.	Norway spruce, Austrian pine.	Pin oak, eastern white pine.

See footnote at end of table.

TABLE 8.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
93D2*, 93D3*: Adair	---	Eastern redcedar, Washington hawthorn, Amur privet, arrowwood, Amur honeysuckle, Tatarian honeysuckle, American cranberrybush.	Austrian pine, green ash, osageorange.	Eastern white pine, pin oak.	---
122 Sperry	---	Amur privet, silky dogwood, Amur honeysuckle, American cranberrybush.	Norway spruce, Austrian pine, northern white-cedar, blue spruce, white fir, Washington hawthorn.	Eastern white pine	Pin oak.
133, 133+ Colo	---	Amur privet, Amur honeysuckle, American cranberrybush, silky dogwood.	Norway spruce, Austrian pine, blue spruce, white fir, northern white-cedar, Washington hawthorn.	Eastern white pine	Pin oak.
163E, 163E2, 163E3, 163F, 163G Fayette	---	Amur privet, Amur honeysuckle, American cranberrybush, silky dogwood.	White fir, blue spruce, northern white-cedar, Washington hawthorn.	Norway spruce, Austrian pine.	Eastern white pine, pin oak.
175 Dickinson	Siberian peashrub	Eastern redcedar, radiant crabapple, Washington hawthorn, autumn-olive, Amur honeysuckle, lilac, Tatarian honeysuckle.	Eastern white pine, Austrian pine, red pine, jack pine.	---	---
179D2, 179E2 Gara	---	Amur honeysuckle, American cranberrybush, Amur privet, silky dogwood.	Northern white-cedar, white fir, Washington hawthorn, blue spruce.	Austrian pine, Norway spruce.	Eastern white pine, pin oak.
180 Keomah	---	Silky dogwood, Amur honeysuckle, Amur privet, American cranberrybush.	Austrian pine, white fir, blue spruce, northern white-cedar, Washington hawthorn.	Norway spruce	Eastern white pine, pin oak.

See footnote at end of table.

TABLE 8.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
192C2, 192D2: Adair	---	Eastern redcedar, Washington hawthorn, Amur privet, arrowwood, Amur honeysuckle, Tatarian honeysuckle, American cranberrybush.	Austrian pine, green ash, osageorange.	Eastern white pine, pin oak.	---
219: Jackson	---	Silky dogwood, American cranberrybush, Amur honeysuckle, Amur privet.	Washington hawthorn, northern white-cedar, blue spruce, white fir.	Austrian pine, Norway spruce.	Pin oak, eastern white pine.
220: Nodaway	---	Amur privet, Amur honeysuckle, American cranberrybush, silky dogwood.	Austrian pine, white fir, blue spruce, northern white-cedar, Washington hawthorn.	Norway spruce.	Eastern white pine, pin oak.
222C2, 222C3, 222D2, 222D3: Clarinda	---	Eastern redcedar, Washington hawthorn, Amur privet, arrowwood, Amur honeysuckle, Tatarian honeysuckle, American cranberrybush.	Green ash, osageorange.	Eastern white pine, pin oak, Austrian pine.	---
223C2, 223D2: Rinda	---	Tatarian honeysuckle, eastern redcedar, Washington hawthorn, arrowwood, Amur honeysuckle, Amur privet, American cranberrybush.	Green ash, Austrian pine, osageorange.	Eastern white pine, pin oak.	---
263: Okaw	---	Amur privet, Amur honeysuckle, American cranberrybush, silky dogwood.	Norway spruce, Austrian pine, northern white-cedar, blue spruce, white fir, Washington hawthorn.	Eastern white pine	Pin oak.
264B: Ainsworth	---	Silky dogwood, American cranberrybush, Amur honeysuckle, Amur privet.	Washington hawthorn, northern white-cedar, blue spruce, white fir.	Austrian pine, Norway spruce.	Pin oak, eastern white pine.

See footnote at end of table.

TABLE 8.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of-- <8	8-15	16-25	26-35	>35
269 Humeston	---	Amur privet, Amur honeysuckle, American cranberrybush, silky dogwood.	Norway spruce, Austrian pine, northern white-cedar, blue spruce, white fir, Washington hawthorn.	Eastern white pine	Pin oak.
279 Taintor	---	Amur privet, silky dogwood, Amur honeysuckle, American cranberrybush.	Austrian pine, Washington hawthorn, northern white-cedar, Norway spruce, blue spruce, white fir.	Eastern white pine	Pin oak.
280 Mahaska	---	Silky dogwood, Amur privet, Amur honeysuckle, American cranberrybush.	Austrian pine, white fir, blue spruce, eastern white pine, Washington hawthorn.	Norway spruce	Eastern white pine, pin oak.
281B, 281B2, 281C, 281C2, 281C3, 281D2, 281D3 Otley	---	Silky dogwood, Amur privet, Amur honeysuckle, American cranberrybush.	White fir, blue spruce, northern white-cedar, Washington hawthorn.	Austrian pine, Norway spruce.	Eastern white pine, pin oak.
293E2*:					
Fayette	---	Amur privet, Amur honeysuckle, American cranberrybush, silky dogwood.	White fir, blue spruce, northern white-cedar, Washington hawthorn.	Norway spruce, Austrian pine.	Eastern white pine, pin oak.
Lamont	---	Amur privet, Washington hawthorn, Amur honeysuckle, American cranberrybush, Tatarian honeysuckle.	Austrian pine, eastern redcedar, northern white-cedar, osageorange.	Eastern white pine, Norway spruce, red pine.	---
Chelsea	Siberian peashrub	Eastern redcedar, radiant crabapple, Washington hawthorn, autumn-olive, Amur honeysuckle, lilac, Tatarian honeysuckle.	Austrian pine, jack pine, red pine.	Eastern white pine	---
294C2*, 294D2*: Ladoga.					

See footnote at end of table.

TABLE 8.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of-- <8	8-15	16-25	26-35	>35
294C2*, 294D2*:					
Billett	---	Amur privet, Washington hawthorn, Amur honeysuckle, American cranberrybush, Tatarian honeysuckle.	Austrian pine, northern white-cedar, osageorange, eastern redcedar.	Eastern white pine, Norway spruce, red pine.	---
295C2*, 295D2*, 295D3*:					
Clinton	---	Amur privet, Amur honeysuckle, American cranberrybush, silky dogwood.	White fir, blue spruce, northern white-cedar, Washington hawthorn.	Norway spruce, Austrian pine.	Eastern white pine, pin oak.
Lamont	---	Amur privet, Washington hawthorn, Amur honeysuckle, American cranberrybush, Tatarian honeysuckle.	Austrian pine, eastern redcedar, northern white-cedar, osageorange.	Eastern white pine, Norway spruce, red pine.	---
295C2*, 295D2*, 295D3*:					
Chelsea	Siberian peashrub	Eastern redcedar, radiant crabapple, Washington hawthorn, autumn-olive, Amur honeysuckle, lilac, Tatarian honeysuckle.	Austrian pine, jack pine, red pine.	Eastern white pine	---
422 Amana	---	Tatarian honeysuckle, silky dogwood, Amur privet, American cranberrybush.	Austrian pine, white fir, blue spruce, northern white-cedar, Washington hawthorn.	Norway spruce	Pin oak, eastern white pine.
424D*, 424D2*, 424D3*, 424E2*: Lindley.					
Keswick	---	Eastern redcedar, Tatarian honeysuckle, Washington hawthorn, arrowwood, Amur privet, Amur honeysuckle, American cranberrybush.	Austrian pine, green ash, osageorange.	Eastern white pine, pin oak.	---

See footnote at end of table.

TABLE 8.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
425D2------------ Keswick	---	Eastern redcedar, Tatarian honeysuckle, Washington hawthorn, arrowwood, Amur privet, Amur honeysuckle, American cranberrybush.	Austrian pine, green ash, osageorange.	Eastern white pine, pin oak.	---
428B------------- Ely	---	Amur privet, Amur honeysuckle, American cranberrybush, silky dogwood.	Austrian pine, white fir, blue spruce, northern white-cedar, Washington hawthorn.	Norway spruce-----	Eastern white pine, pin oak.
430-------------- Ackmore	---	Silky dogwood, Amur honeysuckle, Amur privet, American cranberrybush.	Austrian pine, white fir, blue spruce, northern white-cedar, Washington hawthorn.	Norway spruce-----	Eastern white pine, pin oak.
453-------------- Tuskeego	---	Amur privet, silky dogwood, Amur honeysuckle, American cranberrybush.	Norway spruce, Austrian pine, northern white-cedar, blue spruce, white fir, Washington hawthorn.	Eastern white pine	Pin oak.
484-------------- Lawson	---	Amur privet, Amur honeysuckle, American cranberrybush, silky dogwood.	Austrian pine, white fir, blue spruce, northern white-cedar, Washington hawthorn.	Norway spruce-----	Eastern white pine, pin oak.
499F. Nordness					
520, 520B--------- Coppock	---	Amur privet, silky dogwood, Amur honeysuckle.	Austrian pine, northern white-cedar, white fir, blue spruce, Washington hawthorn.	Norway spruce-----	Eastern white pine, pin oak.
539-------------- Perks	---	Silky dogwood, American cranberrybush, Amur honeysuckle, Amur privet.	Washington hawthorn, northern white-cedar, blue spruce, white fir, Austrian pine.	Norway spruce-----	Pin oak, eastern white pine.

See footnote at end of table.

TABLE 8.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of-- <8	8-15	16-25	26-35	>35
570B, 570B2, 570C2, 570C3 Nira	---	Amur honeysuckle, silky dogwood, Amur privet, American cranberrybush.	White fir, blue spruce, Washington hawthorn, northern white-cedar.	Austrian pine, Norway spruce.	Eastern white pine, pin oak.
571B, 571B2, 571C2, 571C3 Hedrick	---	American cranberrybush, Amur honeysuckle, silky dogwood, Amur privet.	Washington hawthorn, northern white-cedar, blue spruce, white fir.	Norway spruce, Austrian pine.	Eastern white pine, pin oak.
572B, 572C2 Inton	---	American cranberrybush, Amur honeysuckle, Amur privet, silky dogwood.	Washington hawthorn, northern white-cedar, blue spruce.	Austrian pine, Norway spruce.	Eastern white pine, pin oak, silver maple.
592D2 Mystic	---	American cranberrybush, Amur honeysuckle, eastern redcedar, arrowwood, Amur privet, Tatarian honeysuckle, Washington hawthorn.	Osageorange, green ash, Austrian pine.	Pin oak, eastern white pine.	---
687B Watkins	---	Amur privet, Amur honeysuckle, American cranberrybush, silky dogwood.	White fir, blue spruce, northern white-cedar, Washington hawthorn.	Norway spruce, Austrian pine.	Eastern white pine, pin oak.
688 Koszta	---	Silky dogwood, Amur privet, Amur honeysuckle, American cranberrybush.	Austrian pine, white fir, blue spruce, northern white-cedar, Washington hawthorn.	Norway spruce	Eastern white pine, pin oak.
715*:					
Nodaway	---	Amur privet, Amur honeysuckle, American cranberrybush, silky dogwood.	Austrian pine, white fir, blue spruce, northern white-cedar, Washington hawthorn.	Norway spruce	Eastern white pine, pin oak.
Perks	---	Silky dogwood, American cranberrybush, Amur honeysuckle, Amur privet.	Washington hawthorn, northern white-cedar, blue spruce, white fir, Austrian pine.	Norway spruce	Pin oak, eastern white pine.

See footnote at end of table.

TABLE 8.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of-- <8	8-15	16-25	26-35	>35
729B*: Ackmore	---	Silky dogwood, Amur honeysuckle, Amur privet, American cranberrybush.	Austrian pine, white fir, blue spruce, northern white-cedar, Washington hawthorn.	Norway spruce	Eastern white pine, pin oak.
Nodaway	---	Amur privet, Amur honeysuckle, American cranberrybush, silky dogwood.	Austrian pine, white fir, blue spruce, northern white-cedar, Washington hawthorn.	Norway spruce	Eastern white pine, pin oak.
779 Kalona	---	Amur privet, Tatarian honeysuckle, silky dogwood, American cranberrybush.	Norway spruce, northern white-cedar, Austrian pine, blue spruce, white fir, Washington hawthorn.	Eastern white pine	Pin oak.
792C2, 792D2 Armstrong	---	Eastern redcedar, Washington hawthorn, Amur privet, arrowwood, Tatarian honeysuckle, Amur honeysuckle, American cranberrybush.	Austrian pine, green ash, osageorange.	Eastern white pine, pin oak.	---
793B Bertrand	---	Amur honeysuckle, American cranberrybush, Amur privet, silky dogwood.	Northern white-cedar, Washington hawthorn, blue spruce, white fir.	Austrian pine, Norway spruce.	Pin oak, eastern white pine.
795D2 Ashgrove	---	Eastern redcedar, Tatarian honeysuckle, Washington hawthorn, arrowwood, Amur privet, Amur honeysuckle, American cranberrybush.	Austrian pine, green ash, osageorange.	Eastern white pine, pin oak.	---
876B, 876C2 Ladoga	---	Silky dogwood, Amur privet, Amur honeysuckle, American cranberrybush.	White fir, blue spruce, northern white-cedar, Washington hawthorn.	Norway spruce, Austrian pine.	Eastern white pine, pin oak.
880B, 880C2, 880D2 Clinton	---	Amur privet, Amur honeysuckle, American cranberrybush, silky dogwood.	White fir, blue spruce, northern white-cedar, Washington hawthorn.	Norway spruce, Austrian pine.	Eastern white pine, pin oak.

See footnote at end of table.

TABLE 8.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of-- <8	8-15	16-25	26-35	>35
881B: Otley	---	Silky dogwood, Amur privet, Amur honeysuckle, American cranberrybush.	White fir, blue spruce, northern white-cedar, Washington hawthorn.	Austrian pine, Norway spruce.	Eastern white pine, pin oak.
993D2*, 993D3*, 993E2*:					
Gara	---	Amur honeysuckle, American cranberrybush, Amur privet, silky dogwood.	Northern white-cedar, white fir, Washington hawthorn, blue spruce.	Austrian pine, Norway spruce.	Eastern white pine, pin oak.
Armstrong	---	Eastern redcedar, Washington hawthorn, Amur privet, arrowwood, Tatarian honeysuckle, Amur honeysuckle, American cranberrybush.	Austrian pine, green ash, osageorange.	Eastern white pine, pin oak.	---
994D3*:					
Galland	---	Eastern redcedar, Tatarian honeysuckle, Washington hawthorn, arrowwood, Amur privet, Amur honeysuckle, American cranberrybush.	Austrian pine, green ash, osageorange.	Eastern white pine, pin oak.	---
Douds	---	Silky dogwood, Amur privet, American cranberrybush, Amur honeysuckle.	Blue spruce, white fir, northern white-cedar, Washington hawthorn.	Austrian pine, Norway spruce.	Eastern white pine, pin oak.
1075: Givin	---	American cranberrybush, Amur honeysuckle, Amur privet, silky dogwood.	Austrian pine, white fir, blue spruce, northern white-cedar, Washington hawthorn.	Norway spruce	Pin oak, eastern white pine.
1180: Keomah	---	Silky dogwood, Amur honeysuckle, Amur privet, American cranberrybush.	Austrian pine, white fir, blue spruce, northern white-cedar, Washington hawthorn.	Norway spruce	Eastern white pine, pin oak.
1280: Mahaska	---	Silky dogwood, Amur privet, Amur honeysuckle, American cranberrybush.	Austrian pine, white fir, blue spruce, eastern white pine, Washington hawthorn.	Norway spruce	Eastern white pine, pin oak.

See footnote at end of table.

TABLE 8.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of-- <8	8-15	16-25	26-35	>35
1354*. Aquents					
1484 Lawson	---	Amur privet, Amur honeysuckle, American cranberrybush, silky dogwood.	Austrian pine, white fir, blue spruce, northern white-cedar, Washington hawthorn.	Norway spruce	Eastern white pine, pin oak.
2226 Elrin	---	American cranberrybush, Amur honeysuckle, silky dogwood, Amur privet.	White fir, northern white-cedar, blue spruce, Washington hawthorn, Austrian pine.	Norway spruce	Eastern white pine, pin oak.
2242*: Nodaway	---	Amur privet, Amur honeysuckle, American cranberrybush, silky dogwood.	Austrian pine, white fir, blue spruce, northern white-cedar.	Norway spruce	Eastern white pine, pin oak.
Amana	---	Tatarian honeysuckle, silky dogwood, Amur privet, American cranberrybush.	Austrian pine, white fir, blue spruce, northern white-cedar, Washington hawthorn.	Norway spruce	Pin oak, eastern white pine.
5030*. Pits					
5040*. Orthents					

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 9.--RECREATIONAL DEVELOPMENT

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
7B Wiota	Severe: flooding.	Slight	Moderate: slope.	Slight	Slight.
11B*:					
Colo	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.
Ely	Moderate: wetness.	Moderate: wetness.	Moderate: slope, wetness.	Slight	Slight.
24D2 Shelby	Moderate: slope, percs slowly.	Moderate: slope, percs slowly.	Severe: slope.	Slight	Moderate: slope.
41C Sparta	Slight	Slight	Moderate: slope.	Slight	Moderate: droughty.
43 Bremer	Severe: wetness, flooding.	Moderate: wetness, percs slowly.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.
54 Zook	Severe: wetness, flooding.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness, flooding.
58D2 Douds	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight	Moderate: slope.
58E2 Douds	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
65D, 65D2 Lindley	Moderate: slope, percs slowly.	Moderate: slope, percs slowly.	Severe: slope.	Slight	Moderate: slope.
65E Lindley	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
65E2, 65F, 65F2 Lindley	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
65G Lindley	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
74 Rubio	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
75 Givin	Moderate: wetness, percs slowly.	Moderate: wetness, percs slowly.	Moderate: wetness, percs slowly.	Slight	Slight.
76B, 76B2 Ladoga	Moderate: percs slowly.	Moderate: percs slowly.	Moderate: slope, percs slowly.	Slight	Slight.
76C, 76C2, 76C3 Ladoga	Moderate: percs slowly.	Moderate: percs slowly.	Severe: slope.	Slight	Slight.

See footnote at end of table.

TABLE 9.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
76D2, 76D3 Ladoga	Moderate: slope, percs slowly.	Moderate: slope, percs slowly.	Severe: slope.	Slight	Moderate: slope.
80B Clinton	Moderate: percs slowly.	Moderate: percs slowly.	Moderate: slope, percs slowly.	Slight	Slight.
80C, 80C2, 80C3 Clinton	Moderate: percs slowly.	Moderate: percs slowly.	Severe: slope.	Slight	Slight.
80D, 80D2, 80D3 Clinton	Moderate: slope, percs slowly.	Moderate: slope, percs slowly.	Severe: slope.	Severe: erodes easily.	Moderate: slope.
87B*:					
Colo	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.
Zook	Severe: wetness.	Moderate: wetness, percs slowly.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.
88 Nevin	Severe: flooding.	Moderate: wetness.	Moderate: wetness.	Slight	Slight.
93D2*, 93D3*:					
Shelby	Moderate: slope, percs slowly.	Moderate: slope, percs slowly.	Severe: slope.	Slight	Moderate: slope.
Adair	Severe: wetness.	Moderate: wetness, slope, percs slowly.	Severe: slope, wetness.	Moderate: wetness.	Moderate: slope, wetness.
122 Sperry	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
133, 133+ Colo	Severe: flooding, wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness, flooding.
163E Fayette	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope, erodes easily.	Severe: slope.
163E2, 163E3, 163F Fayette	Severe: slope.	Severe: slope.	Severe: slope.	Severe: erodes easily.	Severe: slope.
163G Fayette	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope, erodes easily.	Severe: slope.
175 Dickinson	Slight	Slight	Slight	Slight	Slight.
179D2 Gara	Moderate: percs slowly, slope.	Moderate: slope, percs slowly.	Severe: slope.	Slight	Moderate: slope.
179E2 Gara	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.

See footnote at end of table.

TABLE 9.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
180 Keomah	Moderate: wetness, percs slowly.	Moderate: wetness, percs slowly.	Moderate: wetness, percs slowly.	Slight	Slight.
192C2 Adair	Severe: wetness.	Moderate: wetness, percs slowly.	Severe: slope, wetness.	Moderate: wetness.	Moderate: wetness.
192D2 Adair	Severe: wetness.	Moderate: wetness, slope, percs slowly.	Severe: slope, wetness.	Moderate: wetness.	Moderate: slope, wetness.
219 Jackson	Slight	Slight	Slight	Slight	Slight.
220 Nodaway	Severe: flooding.	Slight	Moderate: flooding.	Slight	Moderate: flooding.
222C2, 222C3 Clarinda	Severe: wetness, percs slowly.	Severe: percs slowly.	Severe: slope, wetness.	Moderate: wetness.	Moderate: wetness.
222D2, 222D3 Clarinda	Severe: wetness, percs slowly.	Severe: percs slowly.	Severe: slope, wetness.	Severe: erodes easily.	Moderate: wetness, slope.
223C2 Rinda	Severe: wetness, percs slowly.	Severe: percs slowly.	Severe: slope, wetness, percs slowly.	Moderate: wetness.	Moderate: wetness.
223D2 Rinda	Severe: wetness, percs slowly.	Severe: percs slowly.	Severe: slope, wetness, percs slowly.	Severe: erodes easily.	Moderate: wetness, slope.
263 Okaw	Severe: flooding, ponding, percs slowly.	Severe: ponding, percs slowly.	Severe: ponding, percs slowly.	Severe: ponding.	Severe: ponding.
264B Ainsworth	Moderate: percs slowly.	Moderate: percs slowly.	Moderate: slope, percs slowly.	Slight	Slight.
269 Humeston	Severe: flooding, wetness, percs slowly.	Severe: wetness, percs slowly.	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.
279 Taintor	Severe: wetness.	Moderate: wetness, percs slowly.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.
280 Mahaska	Moderate: wetness.	Moderate: wetness.	Moderate: wetness.	Slight	Slight.
281B, 281B2 Otley	Slight	Slight	Moderate: slope.	Slight	Slight.
281C, 281C2, 281C3 Otley	Slight	Slight	Severe: slope.	Slight	Slight.

See footnote at end of table.

TABLE 9.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
281D2, 281D3 Otley	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight	Moderate: slope.
293E2*:					
Fayette	Severe: slope.	Severe: slope.	Severe: slope.	Severe: erodes easily.	Severe: slope.
Lamont	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
Chelsea	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
294C2*:					
Ladoga	Moderate: percs slowly.	Moderate: percs slowly.	Severe: slope.	Slight	Slight.
Billett	Slight	Slight	Severe: slope.	Slight	Slight.
294D2*:					
Ladoga	Moderate: slope, percs slowly.	Moderate: slope, percs slowly.	Severe: slope.	Slight	Moderate: slope.
Billett	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight	Moderate: slope.
295C2*:					
Clinton	Moderate: percs slowly.	Moderate: percs slowly.	Severe: slope.	Slight	Slight.
Lamont	Slight	Slight	Severe: slope.	Slight	Slight.
Chelsea	Slight	Slight	Severe: slope.	Slight	Moderate: droughty.
295D2*, 295D3*:					
Clinton	Moderate: slope, percs slowly.	Moderate: slope, percs slowly.	Severe: slope.	Severe: erodes easily.	Moderate: slope.
Lamont	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight	Moderate: slope.
Chelsea	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight	Moderate: slope, droughty.
422 Amana	Severe: flooding.	Moderate: wetness.	Moderate: flooding, wetness.	Slight	Moderate: flooding.
424D*, 424D2*, 424D3*:					
Lindley	Moderate: slope, percs slowly.	Moderate: slope, percs slowly.	Severe: slope.	Slight	Moderate: slope.
Keswick	Severe: wetness.	Moderate: slope, wetness, percs slowly.	Severe: slope, wetness.	Severe: erodes easily.	Moderate: wetness, slope.

See footnote at end of table.

TABLE 9.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
424E2*:					
Lindley	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
Keswick	Severe: slope, wetness.	Severe: slope.	Severe: slope, wetness.	Severe: erodes easily.	Severe: slope.
425D2 Keswick	Severe: wetness.	Moderate: slope, wetness, percs slowly.	Severe: slope, wetness.	Severe: erodes easily.	Moderate: wetness, slope.
428B Ely	Moderate: wetness.	Moderate: wetness.	Moderate: slope, wetness.	Slight	Slight.
430 Ackmore	Severe: flooding, wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness, flooding.
453 Tuskeego	Severe: flooding, wetness, percs slowly.	Severe: wetness, percs slowly.	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.
484 Lawson	Severe: flooding, wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness, flooding.
499F Nordness	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: erodes easily.	Severe: slope, thin layer.
520 Coppock	Severe: flooding, wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness, flooding.
520B Coppock	Severe: flooding, wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.
539 Perks	Severe: flooding.	Slight	Slight	Slight	Severe: droughty.
570B, 570B2 Nira	Slight	Slight	Moderate: slope.	Slight	Slight.
570C2, 570C3 Nira	Slight	Slight	Severe: slope.	Slight	Slight.
571B, 571B2 Hedrick	Slight	Slight	Moderate: slope.	Slight	Slight.
571C2, 571C3 Hedrick	Slight	Slight	Severe: slope.	Slight	Slight.
572B Inton	Slight	Slight	Moderate: slope.	Slight	Slight.
572C2 Inton	Slight	Slight	Severe: slope.	Slight	Slight.

See footnote at end of table.

TABLE 9.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
592D2----------------- Mystic	Moderate: slope, percs slowly.	Moderate: slope, percs slowly.	Severe: slope.	Severe: erodes easily.	Moderate: slope.
687B----------------- Watkins	Severe: flooding.	Slight---------	Moderate: slope.	Slight---------	Slight.
688----------------- Koszta	Severe: flooding.	Moderate: wetness.	Moderate: wetness.	Slight---------	Slight.
715*:					
Nodaway--------------	Severe: flooding.	Moderate: flooding.	Severe: flooding.	Moderate: flooding.	Severe: flooding.
Perks---------------	Severe: flooding.	Slight---------	Slight---------	Slight---------	Severe: droughty.
729B*:					
Ackmore-------------	Severe: flooding, wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness, flooding.
Nodaway-------------	Severe: flooding.	Slight---------	Moderate: flooding.	Slight---------	Moderate: flooding.
779----------------- Kalona	Severe: wetness.	Moderate: wetness, percs slowly.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.
792C2--------------- Armstrong	Severe: wetness.	Moderate: wetness, percs slowly.	Severe: slope, wetness.	Moderate: wetness.	Moderate: wetness.
792D2--------------- Armstrong	Severe: wetness.	Moderate: slope, wetness, percs slowly.	Severe: slope, wetness.	Moderate: wetness.	Moderate: slope, wetness.
793B---------------- Bertrand	Severe: flooding.	Slight---------	Moderate: slope.	Slight---------	Slight.
795D2--------------- Ashgrove	Severe: wetness, percs slowly.	Severe: percs slowly.	Severe: slope, wetness, percs slowly.	Severe: erodes easily.	Moderate: wetness, slope.
876B---------------- Ladoga	Moderate: percs slowly.	Moderate: percs slowly.	Moderate: slope, percs slowly.	Slight---------	Slight.
876C2--------------- Ladoga	Moderate: percs slowly.	Moderate: percs slowly.	Severe: slope.	Slight---------	Slight.
880B---------------- Clinton	Moderate: percs slowly.	Moderate: percs slowly.	Moderate: slope, percs slowly.	Slight---------	Slight.
880C2--------------- Clinton	Moderate: percs slowly.	Moderate: percs slowly.	Severe: slope.	Slight---------	Slight.
880D2--------------- Clinton	Moderate: slope, percs slowly.	Moderate: slope, percs slowly.	Severe: slope.	Severe: erodes easily.	Moderate: slope.

See footnote at end of table.

TABLE 9.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
881B-------------------- Otley	Slight----------	Slight----------	Moderate: slope.	Slight----------	Slight.
993D2*, 993D3*:					
Gara--------------------	Moderate: percs slowly, slope.	Moderate: slope, percs slowly.	Severe: slope.	Slight----------	Moderate: slope.
Armstrong---------------	Severe: wetness.	Moderate: slope, wetness, percs slowly.	Severe: slope, wetness.	Moderate: wetness.	Moderate: slope, wetness.
993E2*:					
Gara--------------------	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
Armstrong---------------	Severe: slope, wetness.	Severe: slope.	Severe: slope, wetness.	Moderate: slope, wetness.	Severe: slope.
994D3*:					
Galland-----------------	Moderate: slope, percs slowly.	Moderate: slope, percs slowly.	Severe: slope.	Severe: erodes easily.	Moderate: slope.
Douds-------------------	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight----------	Moderate: slope.
1075-------------------- Givin	Moderate: wetness, percs slowly.	Moderate: wetness, percs slowly.	Moderate: slope, wetness, percs slowly.	Slight----------	Slight.
1180-------------------- Keomah	Moderate: wetness, percs slowly.	Moderate: wetness, percs slowly.	Moderate: slope, wetness, percs slowly.	Slight----------	Slight.
1280-------------------- Mahaska	Moderate: wetness.	Moderate: wetness.	Moderate: slope, wetness.	Slight----------	Slight.
1354*. Aquents					
1484-------------------- Lawson	Severe: flooding, wetness.	Moderate: flooding, wetness.	Severe: wetness, flooding.	Moderate: wetness, flooding.	Severe: flooding.
2226-------------------- Elrin	Slight----------	Slight----------	Slight----------	Slight----------	Slight.
2242*:					
Nodaway-----------------	Severe: flooding.	Moderate: flooding.	Severe: flooding.	Moderate: flooding.	Severe: flooding.
Amana-------------------	Severe: flooding.	Moderate: flooding, wetness.	Severe: flooding.	Moderate: flooding.	Severe: flooding.
5030*. Pits					
5040*. Orthents					

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 10.--WILDLIFE HABITAT

[See text for definitions of "good," "fair," "poor," and "very poor." Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Potential for habitat elements							Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife
7B----------------- Wiota	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
11B*:										
Colo---------------	Good	Fair	Good	Fair	Poor	Fair	Very poor.	Fair	Fair	Good.
Ely----------------	Good	Good	Good	Good	Good	Fair	Very poor.	Good	Good	Poor.
24D2--------------- Shelby	Fair	Good	Fair	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
41C---------------- Sparta	Fair	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.
43----------------- Bremer	Good	Good	Good	Fair	Poor	Good	Good	Good	Fair	Good.
54----------------- Zook	Good	Fair	Good	Fair	Poor	Good	Good	Fair	Fair	Good.
58D2--------------- Douds	Fair	Good	Fair	Good	Fair	Poor	Poor	Fair	Good	Poor.
58E2--------------- Douds	Very poor.	Good	Fair	Good	Fair	Very poor.	Very poor.	Poor	Good	Very poor.
65D, 65D2---------- Lindley	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
65E---------------- Lindley	Very poor.	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
65E2, 65F, 65F2---- Lindley	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
65G---------------- Lindley	Very poor.	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
74----------------- Rubio	Good	Fair	Fair	Fair	Poor	Good	Good	Fair	Fair	Good.
75----------------- Givin	Good	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
76B, 76B2---------- Ladoga	Good	Good	Fair	Good	Good	Poor	Poor	Good	Good	Poor.
76C, 76C2, 76C3, 76D2, 76D3-------- Ladoga	Fair	Good	Fair	Good	Good	Very poor.	Poor	Fair	Good	Very poor.
80B---------------- Clinton	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
80C, 80C2, 80C3, 80D, 80D2, 80D3--- Clinton	Fair	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.

See footnote at end of table.

TABLE 10.--WILDLIFE HABITAT--Continued

Soil name and map symbol	Potential for habitat elements: Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Wetland plants	Shallow water areas	Potential as habitat for--: Openland wildlife	Woodland wildlife	Wetland wildlife
87B*:										
Colo	Good	Fair	Good	Fair	Poor	Fair	Very poor.	Fair	Fair	Good.
Zook.										
88 Nevin	Good	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
93D2*, 93D3*:										
Shelby	Fair	Good	Fair	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
Adair	Fair	Good	Fair	Fair	Fair	Poor	Poor	Good	Fair	Poor.
122 Sperry	Fair	Fair	Fair	Fair	Poor	Good	Good	Fair	Fair	Good.
133, 133+ Colo	Good	Fair	Good	Fair	Poor	Good	Good	Fair	Fair	Good.
163E Fayette	Very poor.	Very poor.	Good	Good	Good	Very poor.	Very poor.	Very poor.	Good	Very poor.
163E2, 163E3, 163F Fayette	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
163G Fayette	Very poor.	Very poor.	Good	Good	Good	Very poor.	Very poor.	Very poor.	Good	Very poor.
175 Dickinson	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
179D2 Gara	Fair	Good	Fair	Good	Good	Very poor.	Poor	Fair	Good	Poor.
179E2 Gara	Poor	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.
180 Keomah	Good	Good	Fair	Fair	Fair	Fair	Fair	Good	Fair	Fair.
192C2, 192D2 Adair	Fair	Good	Fair	Fair	Fair	Poor	Poor	Good	Fair	Poor.
219 Jackson	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
220 Nodaway	Good	Good	Good	Good	Fair	Fair	Poor	Fair	Good	Fair.
222C2, 222C3, 222D2, 222D3 Clarinda	Poor	Fair	Poor	Fair	Poor	Poor	Poor	Fair	Fair	Poor.
223C2, 223D2 Rinda	Poor	Fair	Poor	Fair	Poor	Very poor.	Very poor.	Fair	Fair	Very poor.
263 Okaw	Fair	Fair	Fair	Fair	Poor	Good	Good	Fair	Fair	Good.
264B Ainsworth	Good	Good	Fair	Good	Good	Poor	Poor	Good	Good	Poor.

See footnote at end of table.

TABLE 10.--WILDLIFE HABITAT--Continued

Soil name and map symbol	Potential for habitat elements: Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Wetland plants	Shallow water areas	Potential as habitat for--: Openland wildlife	Woodland wildlife	Wetland wildlife
269-----------------Humeston	Good	Fair	Fair	Fair	Poor	Good	Good	Fair	Fair	Good.
279-----------------Taintor	Good	Fair	Fair	Fair	Poor	Good	Good	Fair	Fair	Good.
280-----------------Mahaska	Good	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
281B, 281B2---------Otley	Good	Good	Fair	Good	Good	Poor	Poor	Good	Good	Poor.
281C, 281C2, 281C3, 281D2, 281D3------Otley	Fair	Good	Fair	Good	Good	Very poor.	Poor	Fair	Good	Very poor.
293E2*:										
Fayette-----------	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
Lamont-------------	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Fair	Very poor.
Chelsea------------	Very poor.	Fair	Fair	Poor	Poor	Very poor.	Very poor.	Poor	Poor	Very poor.
294C2*, 294D2*:										
Ladoga-------------	Fair	Good	Fair	Good	Good	Very poor.	Poor	Fair	Good	Very poor.
Billett------------	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
295C2*:										
Clinton------------	Fair	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
Lamont-------------	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
Chelsea------------	Poor	Fair	Fair	Poor	Poor	Very poor.	Very poor.	Fair	Poor	Very poor.
295D2*, 295D3*:										
Clinton------------	Fair	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
Lamont-------------	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
Chelsea------------	Very poor.	Fair	Fair	Poor	Poor	Very poor.	Very poor.	Poor	Poor	Very poor.
422-----------------Amana	Good	Good	Good	Good	Fair	Good	Good	Good	Good	Good.
424D*, 424D2*, 424D3*:										
Lindley------------	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
Keswick------------	Fair	Good	Fair	Good	Fair	Very poor.	Poor	Fair	Good	Very poor.

See footnote at end of table.

TABLE 10.--WILDLIFE HABITAT--Continued

Soil name and map symbol	Potential for habitat elements: Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Wetland plants	Shallow water areas	Potential as habitat for--: Openland wildlife	Woodland wildlife	Wetland wildlife
424E2*:										
Lindley	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
Keswick	Poor	Fair	Fair	Good	Fair	Very poor.	Very poor.	Fair	Good	Very poor.
425D2 Keswick	Fair	Good	Fair	Good	Fair	Very poor.	Poor	Fair	Good	Very poor.
428B Ely	Good	Good	Good	Good	Good	Fair	Very poor.	Good	Good	Poor.
430 Ackmore	Fair	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
453 Tuskeego	Good	Fair	Fair	Fair	Poor	Good	Good	Fair	Fair	Good.
484 Lawson	Good	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
499F Nordness	Very poor.	Poor	Poor	Poor	Poor	Very poor.	Very poor.	Poor	Poor	Very poor.
520, 520B Coppock	Good	Fair	Fair	Fair	Poor	Good	Good	Fair	Fair	Good.
539 Perks	Poor	Fair	Fair	Poor	Poor	Very poor.	Very poor.	Fair	Poor	Very poor.
570B, 570B2 Nira	Good	Good	Fair	Good	Good	Poor	Poor	Good	Good	Poor.
570C2, 570C3 Nira	Fair	Good	Fair	Good	Good	Very poor.	Poor	Fair	Good	Very poor.
571B, 571B2 Hedrick	Good	Good	Fair	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
571C2, 571C3 Hedrick	Fair	Good	Fair	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
572B Inton	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
572C2 Inton	Fair	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
592D2 Mystic	Fair	Good	Fair	Good	Fair	Very poor.	Poor	Fair	Good	Very poor.
687B Watkins	Good	Good	Fair	Good	Good	Poor	Poor	Good	Good	Poor.
688 Koszta	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
715*:										
Nodaway	Poor	Fair	Fair	Poor	Poor	Good	Fair	Poor	Poor	Fair.
Perks	Poor	Fair	Fair	Poor	Poor	Very poor.	Very poor.	Fair	Poor	Very poor.

See footnote at end of table.

TABLE 10.--WILDLIFE HABITAT--Continued

Soil name and map symbol	Potential for habitat elements: Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Wetland plants	Shallow water areas	Potential as habitat for--: Openland wildlife	Woodland wildlife	Wetland wildlife
729B*:										
Ackmore	Fair	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
Nodaway	Good	Good	Good	Good	Fair	Fair	Poor	Fair	Good	Fair.
779 Kalona	Good	Fair	Fair	Fair	Poor	Good	Good	Fair	Fair	Good.
792C2, 792D2 Armstrong	Fair	Good	Fair	Good	Fair	Very poor.	Poor	Fair	Good	Very poor.
793B Bertrand	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
795D2 Ashgrove	Poor	Fair	Poor	Fair	Poor	Poor	Poor	Fair	Fair	Poor.
876B Ladoga	Good	Good	Fair	Good	Good	Poor	Poor	Good	Good	Poor.
876C2 Ladoga	Fair	Good	Fair	Good	Good	Very poor.	Poor	Fair	Good	Very poor.
880B Clinton	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
880C2, 880D2 Clinton	Fair	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
881B Otley	Good	Good	Fair	Good	Good	Poor	Poor	Good	Good	Poor.
993D2*, 993D3*:										
Gara	Fair	Good	Fair	Good	Good	Very poor.	Poor	Fair	Good	Poor.
Armstrong	Fair	Good	Fair	Good	Fair	Very poor.	Poor	Fair	Good	Very poor.
993E2*:										
Gara	Poor	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.
Armstrong	Poor	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.
994D3*:										
Galland	Fair	Good	Fair	Good	Fair	Very poor.	Poor	Fair	Good	Very poor.
Douds	Fair	Good	Fair	Good	Fair	Poor	Poor	Fair	Good	Poor.
1075 Givin	Good	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
1180 Keomah	Good	Good	Fair	Fair	Fair	Fair	Fair	Good	Fair	Fair.
1280 Mahaska	Good	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
1354*. Aquents										

See footnote at end of table.

TABLE 10.--WILDLIFE HABITAT--Continued

Soil name and map symbol	Potential for habitat elements: Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Wetland plants	Shallow water areas	Potential as habitat for--: Openland wildlife	Woodland wildlife	Wetland wildlife
1484---------------- Lawson	Poor	Fair	Fair	Good	Good	Fair	Fair	Fair	Good	Fair.
2226---------------- Elrin	Good	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
2242*:										
Nodaway------------	Poor	Fair	Fair	Poor	Poor	Good	Fair	Poor	Poor	Fair.
Amana--------------	Good	Good	Good	Good	Fair	Good	Good	Good	Good	Good.
5030*. Pits										
5040*. Orthents										

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 11.--BUILDING SITE DEVELOPMENT

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not rated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation]

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
7B Wiota	Slight	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: low strength, frost action.	Slight.
11B*:						
Colo	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: low strength, frost action, shrink-swell.	Moderate: wetness.
Ely	Severe: wetness.	Severe: low strength.	Severe: low strength, wetness.	Severe: low strength.	Severe: frost action, low strength.	Slight.
24D2 Shelby	Moderate: slope.	Moderate: slope, shrink-swell.	Moderate: slope, shrink-swell.	Severe: slope.	Severe: low strength.	Moderate: slope.
41C Sparta	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Slight	Moderate: droughty.
43 Bremer	Severe: wetness.	Severe: wetness, shrink-swell, flooding.	Severe: wetness, shrink-swell, flooding.	Severe: wetness, shrink-swell, flooding.	Severe: low strength, frost action.	Moderate: wetness.
54 Zook	Severe: wetness.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, low strength, frost action.	Moderate: wetness, flooding.
58D2 Douds	Severe: cutbanks cave.	Moderate: shrink-swell, slope.	Moderate: wetness, slope.	Severe: slope.	Moderate: low strength, slope, frost action.	Moderate: slope.
58E2 Douds	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
65D, 65D2 Lindley	Moderate: slope.	Moderate: shrink-swell, slope.	Moderate: slope, shrink-swell.	Severe: slope.	Severe: low strength.	Moderate: slope.
65E, 65E2, 65F, 65F2, 65G Lindley	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: low strength, slope.	Severe: slope.
74 Rubio	Severe: wetness.	Severe: shrink-swell, wetness.	Severe: shrink-swell, wetness.	Severe: shrink-swell, wetness.	Severe: shrink-swell, wetness, low strength.	Severe: wetness.
75 Givin	Severe: wetness.	Moderate: wetness, shrink-swell.	Severe: wetness.	Moderate: wetness, shrink-swell.	Severe: frost action, low strength.	Slight.

See footnote at end of table.

TABLE 11.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
76B, 76B2: Ladoga	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: low strength.	Slight.
76C, 76C2, 76C3: Ladoga	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, slope.	Severe: low strength.	Slight.
76D2, 76D3: Ladoga	Moderate: slope.	Moderate: shrink-swell, slope.	Moderate: slope, shrink-swell.	Severe: slope.	Severe: low strength.	Moderate: slope.
80B: Clinton	Moderate: too clayey.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: low strength.	Slight.
80C, 80C2, 80C3: Clinton	Moderate: too clayey.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, slope.	Severe: low strength.	Slight.
80D, 80D2, 80D3: Clinton	Moderate: too clayey, slope.	Moderate: shrink-swell, slope.	Moderate: slope, shrink-swell.	Severe: slope.	Severe: low strength.	Moderate: slope.
87B*:						
Colo	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: low strength, frost action, shrink-swell.	Moderate: wetness.
Zook	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: low strength, frost action, shrink-swell.	Moderate: wetness.
88: Nevin	Severe: wetness.	Severe: flooding.	Severe: wetness, flooding.	Severe: flooding.	Severe: frost action, low strength.	Slight.
93D2*, 93D3*:						
Shelby	Moderate: slope.	Moderate: slope, shrink-swell.	Moderate: slope, shrink-swell.	Severe: slope.	Severe: low strength.	Moderate: slope.
Adair	Severe: wetness.	Severe: shrink-swell, wetness.	Severe: wetness.	Severe: shrink-swell, wetness, slope.	Severe: low strength, frost action.	Moderate: slope, wetness.
122: Sperry	Severe: ponding.	Severe: ponding, shrink-swell.	Severe: ponding, shrink-swell.	Severe: ponding, shrink-swell.	Severe: low strength, ponding, frost action.	Severe: ponding.
133, 133+: Colo	Severe: wetness.	Severe: flooding, shrink-swell, wetness.	Severe: flooding, shrink-swell, wetness.	Severe: flooding, shrink-swell, wetness.	Severe: flooding, low strength, frost action.	Moderate: wetness, flooding.
163E, 163E2: Fayette	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: frost action, low strength, slope.	Severe: slope.

See footnote at end of table.

TABLE 11.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
163E3 Fayette	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: low strength, slope, frost action.	Severe: slope.
163F, 163G Fayette	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: frost action, low strength, slope.	Severe: slope.
175 Dickinson	Severe: cutbanks cave.	Slight	Slight	Slight	Moderate: frost action.	Slight.
179D2 Gara	Moderate: slope.	Moderate: slope, shrink-swell.	Moderate: slope, shrink-swell.	Severe: slope.	Severe: low strength.	Moderate: slope.
179E2 Gara	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: low strength, slope.	Severe: slope.
180 Keomah	Severe: wetness.	Severe: shrink-swell.	Severe: wetness, shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, frost action, low strength.	Slight.
192C2 Adair	Severe: wetness.	Severe: shrink-swell, wetness.	Severe: wetness.	Severe: shrink-swell, wetness.	Severe: low strength, frost action.	Moderate: wetness.
192D2 Adair	Severe: wetness.	Severe: shrink-swell, wetness.	Severe: wetness.	Severe: shrink-swell, wetness, slope.	Severe: low strength, frost action.	Moderate: slope, wetness.
219 Jackson	Severe: cutbanks cave.	Moderate: shrink-swell.	Moderate: wetness, shrink-swell.	Moderate: shrink-swell.	Severe: low strength, frost action.	Slight.
220 Nodaway	Moderate: wetness, flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding, frost action, low strength.	Moderate: flooding.
222C2, 222C3 Clarinda	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: low strength, frost action, shrink-swell.	Moderate: wetness.
222D2, 222D3 Clarinda	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell, slope.	Severe: low strength, frost action, shrink-swell.	Moderate: wetness, slope.
223C2 Rinda	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: frost action, low strength, shrink-swell.	Moderate: wetness.
223D2 Rinda	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell, slope.	Severe: frost action, low strength, shrink-swell.	Moderate: wetness, slope.

See footnote at end of table.

TABLE 11.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
263----------- Okaw	Severe: ponding.	Severe: flooding, ponding, shrink-swell.	Severe: flooding, ponding, shrink-swell.	Severe: flooding, ponding, shrink-swell.	Severe: low strength, ponding.	Severe: ponding.
264B----------- Ainsworth	Severe: cutbanks cave.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: low strength, frost action.	Slight.
269----------- Humeston	Severe: wetness.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, wetness, shrink-swell.	Severe: wetness, low strength, flooding.	Severe: wetness, flooding.
279----------- Taintor	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: low strength, frost action, shrink-swell.	Moderate: wetness.
280----------- Mahaska	Severe: wetness.	Moderate: shrink-swell, wetness.	Severe: wetness.	Moderate: shrink-swell, wetness.	Severe: low strength, frost action.	Slight.
281B, 281B2------- Otley	Slight---------	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: low strength.	Slight.
281C, 281C2, 281C3----------- Otley	Slight---------	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: slope, shrink-swell.	Severe: low strength.	Slight.
281D2, 281D3------ Otley	Moderate: slope.	Moderate: shrink-swell, slope.	Moderate: slope, shrink-swell.	Severe: slope.	Severe: low strength.	Moderate: slope.
293E2*:						
Fayette----------	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: frost action, low strength, slope.	Severe: slope.
Lamont-----------	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Chelsea----------	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
294C2*:						
Ladoga-----------	Slight---------	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, slope.	Severe: low strength.	Slight.
Billett----------	Severe: cutbanks cave.	Slight---------	Slight---------	Moderate: slope.	Moderate: frost action.	Slight.
294D2*:						
Ladoga-----------	Moderate: slope.	Moderate: shrink-swell, slope.	Moderate: slope, shrink-swell.	Severe: slope.	Severe: low strength.	Moderate: slope.

See footnote at end of table.

TABLE 11.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
294D2*:						
Billett	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope, frost action.	Moderate: slope.
295C2*:						
Clinton	Moderate: too clayey.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, slope.	Severe: low strength.	Slight.
Lamont	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Moderate: frost action.	Slight.
Chelsea	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Slight	Moderate: droughty.
295D2*, 295D3*:						
Clinton	Moderate: too clayey, slope.	Moderate: shrink-swell, slope.	Moderate: slope, shrink-swell.	Severe: slope.	Severe: low strength.	Moderate: slope.
Lamont	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope, frost action.	Moderate: slope.
Chelsea	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: slope, droughty.
422 Amana	Severe: wetness.	Severe: flooding.	Severe: flooding, wetness.	Severe: flooding.	Severe: flooding, low strength, frost action.	Moderate: flooding.
424D*, 424D2*, 424D3*:						
Lindley	Moderate: slope.	Moderate: shrink-swell, slope.	Moderate: slope, shrink-swell.	Severe: slope.	Severe: low strength.	Moderate: slope.
Keswick	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: wetness.	Severe: wetness, shrink-swell, slope.	Severe: low strength, frost action.	Moderate: wetness, slope.
424E2*:						
Lindley	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: low strength, slope.	Severe: slope.
Keswick	Severe: wetness, slope.	Severe: wetness, shrink-swell, slope.	Severe: wetness, slope.	Severe: wetness, shrink-swell, slope.	Severe: low strength, slope, frost action.	Severe: slope.
425D2 Keswick	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: wetness.	Severe: wetness, shrink-swell, slope.	Severe: low strength, frost action.	Moderate: wetness, slope.
428B Ely	Severe: wetness.	Severe: low strength.	Severe: low strength, wetness.	Severe: low strength.	Severe: frost action, low strength.	Slight.

See footnote at end of table.

TABLE 11.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
430------------- Ackmore	Severe: wetness.	Severe: flooding, wetness.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, wetness.	Severe: low strength, flooding, frost action.	Moderate: wetness, flooding.
453------------- Tuskeego	Severe: wetness.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, wetness, shrink-swell.	Severe: low strength, wetness, shrink-swell.	Severe: wetness.
484------------- Lawson	Severe: wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, frost action.	Moderate: wetness, flooding.
499F------------ Nordness	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: slope, thin layer.
520------------- Coppock	Severe: wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, low strength, frost action.	Moderate: wetness, flooding.
520B------------ Coppock	Severe: wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: low strength, frost action.	Moderate: wetness.
539------------- Perks	Severe: cutbanks cave.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: droughty.
570B, 570B2------- Nira	Moderate: wetness.	Moderate: shrink-swell.	Moderate: wetness, shrink-swell.	Moderate: shrink-swell.	Severe: low strength, frost action.	Slight.
570C2, 570C3------ Nira	Moderate: wetness.	Moderate: shrink-swell.	Moderate: wetness, shrink-swell.	Moderate: shrink-swell, slope.	Severe: low strength, frost action.	Slight.
571B, 571B2------- Hedrick	Moderate: wetness.	Moderate: shrink-swell.	Moderate: wetness, shrink-swell.	Moderate: shrink-swell.	Severe: low strength, frost action.	Slight.
571C2, 571C3------ Hedrick	Moderate: wetness.	Moderate: shrink-swell.	Moderate: wetness, shrink-swell.	Moderate: shrink-swell, slope.	Severe: low strength, frost action.	Slight.
572B------------ Inton	Moderate: wetness.	Moderate: shrink-swell.	Moderate: wetness, shrink-swell.	Moderate: shrink-swell.	Severe: low strength, frost action.	Slight.
572C2----------- Inton	Moderate: wetness.	Moderate: shrink-swell.	Moderate: wetness, shrink-swell.	Moderate: shrink-swell, slope.	Severe: low strength, frost action.	Slight.
592D2----------- Mystic	Moderate: too clayey, wetness, slope.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, slope.	Severe: low strength, frost action.	Moderate: slope.
687B------------ Watkins	Slight---------	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: frost action, low strength.	Slight.

See footnote at end of table.

TABLE 11.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
688: Koszta	Severe: wetness.	Severe: flooding.	Severe: flooding, wetness.	Severe: flooding.	Severe: low strength, frost action.	Slight.
715*:						
Nodaway	Moderate: wetness, flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding, frost action, low strength.	Severe: flooding.
Perks	Severe: cutbanks cave.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: droughty.
729B*:						
Ackmore	Severe: wetness.	Severe: flooding, wetness.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, wetness.	Severe: low strength, flooding, frost action.	Moderate: wetness, flooding.
Nodaway	Moderate: wetness, flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding, frost action, low strength.	Moderate: flooding.
779: Kalona	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: shrink-swell, low strength, frost action.	Moderate: wetness.
792C2: Armstrong	Severe: wetness.	Severe: shrink-swell, wetness.	Severe: wetness, shrink-swell.	Severe: shrink-swell, wetness.	Severe: low strength, frost action.	Moderate: wetness.
792D2: Armstrong	Severe: wetness.	Severe: shrink-swell, wetness.	Severe: wetness, shrink-swell.	Severe: shrink-swell, wetness, slope.	Severe: low strength, frost action.	Moderate: slope, wetness.
793B: Bertrand	Severe: cutbanks cave.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: low strength, frost action.	Slight.
795D2: Ashgrove	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell, slope.	Severe: low strength, frost action, shrink-swell.	Moderate: wetness, slope.
876B: Ladoga	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: low strength.	Slight.
876C2: Ladoga	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, slope.	Severe: low strength.	Slight.
880B: Clinton	Moderate: too clayey.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: low strength.	Slight.
880C2: Clinton	Moderate: too clayey.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, slope.	Severe: low strength.	Slight.

See footnote at end of table.

TABLE 11.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
880D2: Clinton	Moderate: too clayey, slope.	Moderate: shrink-swell, slope.	Moderate: slope, shrink-swell.	Severe: slope.	Severe: low strength.	Moderate: slope.
881B: Otley	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: low strength.	Slight.
993D2*, 993D3*:						
Gara	Moderate: slope.	Moderate: slope, shrink-swell.	Moderate: slope, shrink-swell.	Severe: slope.	Severe: low strength.	Moderate: slope.
Armstrong	Severe: wetness.	Severe: shrink-swell, wetness.	Severe: wetness, shrink-swell.	Severe: shrink-swell, wetness, slope.	Severe: low strength, frost action.	Moderate: slope, wetness.
993E2*:						
Gara	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: low strength, slope.	Severe: slope.
Armstrong	Severe: wetness, slope.	Severe: shrink-swell, wetness, slope.	Severe: slope, wetness, shrink-swell.	Severe: shrink-swell, wetness, slope.	Severe: low strength, frost action, slope.	Severe: slope.
994D3*:						
Galland	Moderate: too clayey, wetness, slope.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, slope.	Severe: low strength, frost action.	Moderate: slope.
Douds	Severe: cutbanks cave.	Moderate: shrink-swell, slope.	Moderate: wetness, slope.	Severe: slope.	Moderate: low strength, slope, frost action.	Moderate: slope.
1075: Givin	Severe: wetness.	Moderate: wetness, shrink-swell.	Severe: wetness.	Moderate: wetness, shrink-swell.	Severe: frost action, low strength.	Slight.
1180: Keomah	Severe: wetness.	Severe: shrink-swell.	Severe: wetness, shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, frost action, low strength.	Slight.
1280: Mahaska	Severe: wetness.	Moderate: shrink-swell, wetness.	Severe: wetness.	Moderate: shrink-swell, wetness.	Severe: low strength, frost action.	Slight.
1354*. Aquents						
1484: Lawson	Severe: wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, frost action.	Severe: flooding.
2226: Elrin	Severe: cutbanks cave.	Slight	Moderate: wetness.	Slight	Severe: frost action.	Slight.

See footnote at end of table.

TABLE 11.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
2242*:						
Nodaway----------	Moderate: wetness, flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding, frost action, low strength.	Severe: flooding.
Amana------------	Severe: wetness.	Severe: flooding.	Severe: flooding, wetness.	Severe: flooding.	Severe: flooding, low strength, frost action.	Severe: flooding.
5030*. Pits						
5040*. Orthents						

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 12.--SANITARY FACILITIES

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "poor," and other terms. Absence of an entry indicates that the soil was not rated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation]

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
7B------------------ Wiota	Moderate: flooding, percs slowly.	Moderate: seepage, slope.	Moderate: flooding, too clayey.	Moderate: flooding.	Fair: too clayey.
11B*:					
Colo----------------	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Poor: hard to pack, wetness.
Ely-----------------	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Fair: wetness.
24D2---------------- Shelby	Severe: percs slowly.	Severe: slope.	Moderate: too clayey, slope.	Moderate: slope.	Fair: too clayey, slope.
41C----------------- Sparta	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
43------------------ Bremer	Severe: percs slowly, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Poor: wetness.
54------------------ Zook	Severe: percs slowly, wetness, flooding.	Severe: flooding.	Severe: wetness, too clayey, flooding.	Severe: wetness, flooding.	Poor: too clayey, wetness, hard to pack.
58D2---------------- Douds	Moderate: wetness, percs slowly, slope.	Severe: seepage, slope.	Severe: seepage, wetness.	Severe: seepage.	Fair: too clayey, too sandy, slope.
58E2---------------- Douds	Severe: slope.	Severe: seepage, slope.	Severe: seepage, wetness, slope.	Severe: seepage, slope.	Poor: slope.
65D, 65D2----------- Lindley	Severe: percs slowly.	Severe: slope.	Moderate: slope, too clayey.	Moderate: slope.	Fair: too clayey, slope.
65E, 65E2, 65F, 65F2, 65G---------- Lindley	Severe: percs slowly, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
74------------------ Rubio	Severe: percs slowly, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Poor: wetness, hard to pack.
75------------------ Givin	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Fair: too clayey, wetness.

See footnote at end of table.

TABLE 12.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
76B, 76B2----------- Ladoga	Severe: percs slowly.	Moderate: seepage, slope.	Moderate: too clayey.	Slight-----------	Fair: too clayey.
76C, 76C2, 76C3----- Ladoga	Severe: percs slowly.	Severe: slope.	Moderate: too clayey.	Slight-----------	Fair: too clayey.
76D2, 76D3---------- Ladoga	Severe: percs slowly.	Severe: slope.	Moderate: too clayey, slope.	Moderate: slope.	Fair: too clayey, slope.
80B----------------- Clinton	Severe: percs slowly.	Moderate: seepage, slope.	Severe: too clayey.	Slight-----------	Poor: too clayey, hard to pack.
80C, 80C2, 80C3----- Clinton	Severe: percs slowly.	Severe: slope.	Severe: too clayey.	Slight-----------	Poor: too clayey, hard to pack.
80D, 80D2, 80D3----- Clinton	Severe: percs slowly.	Severe: slope.	Severe: too clayey.	Moderate: slope.	Poor: too clayey, hard to pack.
87B*:					
Colo----------------	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Poor: hard to pack, wetness.
Zook----------------	Severe: wetness, percs slowly.	Slight-----------	Severe: wetness, too clayey.	Severe: wetness.	Poor: too clayey, hard to pack, wetness.
88------------------ Nevin	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Fair: too clayey, wetness.
93D2*, 93D3*:					
Shelby--------------	Severe: percs slowly.	Severe: slope.	Moderate: too clayey, slope.	Moderate: slope.	Fair: too clayey, slope.
Adair---------------	Severe: percs slowly, wetness.	Severe: slope, wetness.	Severe: wetness.	Severe: wetness.	Poor: wetness.
122----------------- Sperry	Severe: ponding, percs slowly.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Poor: ponding.
133, 133+----------- Colo	Severe: wetness, flooding.	Severe: wetness, flooding.	Severe: wetness, flooding.	Severe: wetness, flooding.	Poor: wetness, hard to pack.
163E, 163E2, 163E3, 163F, 163G--------- Fayette	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
175----------------- Dickinson	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.

See footnote at end of table.

TABLE 12.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
179D2 Gara	Severe: percs slowly.	Severe: slope.	Moderate: too clayey, slope.	Moderate: slope.	Fair: too clayey, slope.
179E2 Gara	Severe: percs slowly, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
180 Keomah	Severe: percs slowly, wetness.	Severe: wetness.	Severe: wetness, too clayey.	Severe: wetness.	Poor: too clayey, hard to pack.
192C2, 192D2 Adair	Severe: percs slowly, wetness.	Severe: slope, wetness.	Severe: wetness.	Severe: wetness.	Poor: wetness.
219 Jackson	Severe: wetness.	Severe: seepage, wetness.	Severe: seepage, wetness.	Severe: wetness.	Fair: too clayey, wetness.
220 Nodaway	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Fair: wetness.
222C2, 222C3, 222D2, 222D3 Clarinda	Severe: wetness, percs slowly.	Severe: slope.	Severe: wetness, too clayey.	Severe: wetness.	Poor: too clayey, hard to pack, wetness.
223C2, 223D2 Rinda	Severe: percs slowly, wetness.	Severe: slope.	Severe: too clayey, wetness.	Severe: wetness.	Poor: too clayey, wetness, hard to pack.
263 Okaw	Severe: ponding, percs slowly.	Slight	Severe: ponding, too clayey.	Severe: ponding.	Poor: too clayey, hard to pack, ponding.
264B Ainsworth	Severe: percs slowly.	Severe: seepage.	Severe: seepage.	Slight	Fair: too clayey, thin layer.
269 Humeston	Severe: wetness, percs slowly, flooding.	Severe: flooding.	Severe: wetness, too clayey, flooding.	Severe: wetness, flooding.	Poor: wetness, too clayey.
279 Taintor	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Poor: wetness.
280 Mahaska	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Fair: too clayey, wetness.
281B, 281B2 Otley	Moderate: percs slowly.	Moderate: slope, seepage.	Moderate: too clayey.	Slight	Fair: too clayey.
281C, 281C2, 281C3 Otley	Moderate: percs slowly.	Severe: slope.	Moderate: too clayey.	Slight	Fair: too clayey.

See footnote at end of table.

TABLE 12.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
281D2, 281D3 Otley	Moderate: slope, percs slowly.	Severe: slope.	Moderate: too clayey, slope.	Moderate: slope.	Fair: too clayey, slope.
293E2*:					
Fayette	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
Lamont	Severe: slope.	Severe: seepage, slope.	Severe: seepage, slope.	Severe: seepage, slope.	Poor: slope.
Chelsea	Severe: slope, poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy, slope.	Severe: seepage, slope.	Poor: too sandy, slope, seepage.
294C2*:					
Ladoga	Severe: percs slowly.	Severe: slope.	Moderate: too clayey.	Slight	Fair: too clayey.
Billett	Slight	Severe: seepage, slope.	Severe: seepage.	Severe: seepage.	Fair: too sandy, thin layer.
294D2*:					
Ladoga	Severe: percs slowly.	Severe: slope.	Moderate: too clayey, slope.	Moderate: slope.	Fair: too clayey, slope.
Billett	Moderate: slope.	Severe: seepage, slope.	Severe: seepage.	Severe: seepage.	Fair: too sandy, slope, thin layer.
295C2*:					
Clinton	Severe: percs slowly.	Severe: slope.	Severe: too clayey.	Slight	Poor: too clayey, hard to pack.
Lamont	Slight	Severe: seepage, slope.	Severe: seepage.	Severe: seepage.	Fair: thin layer.
Chelsea	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: too sandy, seepage.
295D2*, 295D3*:					
Clinton	Severe: percs slowly.	Severe: slope.	Severe: too clayey.	Moderate: slope.	Poor: too clayey, hard to pack.
Lamont	Moderate: slope.	Severe: seepage, slope.	Severe: seepage.	Severe: seepage.	Fair: slope, thin layer.
Chelsea	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: too sandy, seepage.
422 Amana	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Fair: wetness.

See footnote at end of table.

TABLE 12.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
424D*, 424D2*, 424D3*:					
Lindley	Severe: percs slowly.	Severe: slope.	Moderate: slope, too clayey.	Moderate: slope.	Fair: too clayey, slope.
Keswick	Severe: wetness, percs slowly.	Severe: slope, wetness.	Severe: wetness.	Severe: wetness.	Poor: wetness.
424E2*:					
Lindley	Severe: percs slowly, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
Keswick	Severe: wetness, percs slowly, slope.	Severe: slope, wetness.	Severe: wetness, slope.	Severe: wetness, slope.	Poor: slope, wetness.
425D2 Keswick	Severe: wetness, percs slowly.	Severe: slope, wetness.	Severe: wetness.	Severe: wetness.	Poor: wetness.
428B Ely	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Fair: wetness.
430 Ackmore	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Poor: wetness, hard to pack.
453 Tuskeego	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness, too clayey.	Severe: wetness.	Poor: too clayey, hard to pack, wetness.
484 Lawson	Severe: flooding, wetness.	Severe: wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Poor: wetness.
499F Nordness	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: slope, depth to rock.	Poor: area reclaim, slope.
520 Coppock	Severe: wetness, flooding.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Poor: wetness.
520B Coppock	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Poor: wetness.
539 Perks	Severe: flooding, poor filter.	Severe: flooding, seepage.	Severe: flooding, seepage, too sandy.	Severe: flooding, seepage.	Poor: seepage, too sandy.
570B, 570B2 Nira	Moderate: wetness, percs slowly.	Moderate: seepage, slope, wetness.	Severe: wetness.	Moderate: wetness.	Poor: hard to pack.

See footnote at end of table.

TABLE 12.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
570C2, 570C3: Nira	Moderate: wetness, percs slowly.	Severe: slope.	Severe: wetness.	Moderate: wetness.	Poor: hard to pack.
571B, 571B2: Hedrick	Moderate: wetness, percs slowly.	Moderate: seepage, slope, wetness.	Severe: wetness.	Moderate: wetness.	Poor: hard to pack.
571C2, 571C3: Hedrick	Moderate: wetness, percs slowly.	Severe: slope.	Severe: wetness.	Moderate: wetness.	Poor: hard to pack.
572B: Inton	Moderate: wetness.	Moderate: seepage, slope, wetness.	Severe: wetness.	Moderate: wetness.	Poor: hard to pack.
572C2: Inton	Moderate: wetness.	Severe: slope.	Severe: wetness.	Moderate: wetness.	Poor: hard to pack.
592D2: Mystic	Severe: wetness, percs slowly.	Severe: seepage, slope, wetness.	Severe: seepage, too clayey.	Moderate: slope.	Poor: too clayey, hard to pack.
687B: Watkins	Moderate: flooding.	Moderate: slope, seepage.	Moderate: too clayey, flooding.	Moderate: flooding.	Fair: too clayey.
688: Koszta	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Fair: too clayey, wetness.
715*:					
Nodaway	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Fair: wetness.
Perks	Severe: flooding, poor filter.	Severe: flooding, seepage.	Severe: flooding, seepage, too sandy.	Severe: flooding, seepage.	Poor: seepage, too sandy.
729B*:					
Ackmore	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Poor: wetness, hard to pack.
Nodaway	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Fair: wetness.
779: Kalona	Severe: percs slowly, wetness.	Severe: wetness.	Severe: wetness, too clayey.	Severe: wetness.	Poor: wetness, too clayey, hard to pack.
792C2, 792D2: Armstrong	Severe: percs slowly, wetness.	Severe: slope.	Severe: wetness, too clayey.	Severe: wetness.	Poor: too clayey, hard to pack.

See footnote at end of table.

TABLE 12.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
793B---------------- Bertrand	Moderate: flooding, percs slowly.	Severe: seepage.	Severe: seepage.	Moderate: flooding.	Fair: too clayey, thin layer.
795D2--------------- Ashgrove	Severe: wetness, percs slowly.	Severe: slope.	Severe: wetness, too clayey.	Severe: wetness.	Poor: too clayey, hard to pack, wetness.
876B---------------- Ladoga	Severe: percs slowly.	Moderate: seepage, slope.	Moderate: too clayey.	Slight-----------	Fair: too clayey.
876C2--------------- Ladoga	Severe: percs slowly.	Severe: slope.	Moderate: too clayey.	Slight-----------	Fair: too clayey.
880B---------------- Clinton	Severe: percs slowly.	Moderate: seepage, slope.	Severe: too clayey.	Slight-----------	Poor: too clayey, hard to pack.
880C2--------------- Clinton	Severe: percs slowly.	Severe: slope.	Severe: too clayey.	Slight-----------	Poor: too clayey, hard to pack.
880D2--------------- Clinton	Severe: percs slowly.	Severe: slope.	Severe: too clayey.	Moderate: slope.	Poor: too clayey, hard to pack.
881B---------------- Otley	Moderate: percs slowly.	Moderate: slope, seepage.	Moderate: too clayey.	Slight-----------	Fair: too clayey.
993D2*, 993D3*:					
Gara---------------	Severe: percs slowly.	Severe: slope.	Moderate: too clayey, slope.	Moderate: slope.	Fair: too clayey, slope.
Armstrong----------	Severe: percs slowly, wetness.	Severe: slope.	Severe: wetness, too clayey.	Severe: wetness.	Poor: too clayey, hard to pack.
993E2*:					
Gara---------------	Severe: percs slowly, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
Armstrong----------	Severe: percs slowly, slope, wetness.	Severe: slope.	Severe: slope, wetness, too clayey.	Severe: wetness, slope.	Poor: slope, too clayey, hard to pack.
994D3*:					
Galland------------	Severe: wetness, percs slowly.	Severe: slope.	Severe: seepage, too clayey.	Moderate: slope.	Poor: too clayey, hard to pack.
Douds--------------	Moderate: wetness, percs slowly, slope.	Severe: seepage, slope.	Severe: seepage, wetness.	Severe: seepage.	Fair: too clayey, too sandy, slope.

See footnote at end of table.

TABLE 12.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
1075---------------- Givin	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Fair: too clayey, wetness.
1180---------------- Keomah	Severe: percs slowly, wetness.	Severe: wetness.	Severe: wetness, too clayey.	Severe: wetness.	Poor: too clayey, hard to pack.
1280---------------- Mahaska	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Fair: too clayey, wetness.
1354*. Aquents					
1484---------------- Lawson	Severe: flooding, wetness.	Severe: wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Poor: wetness.
2226---------------- Elrin	Severe: wetness.	Severe: seepage, wetness.	Severe: wetness, seepage.	Severe: seepage, wetness.	Poor: seepage.
2242*:					
Nodaway------------	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Fair: wetness.
Amana--------------	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Fair: wetness.
5030*. Pits					
5040*. Orthents					

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 13.--CONSTRUCTION MATERIALS

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "good," "fair," and other terms. Absence of an entry indicates that the soil was not rated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation]

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
7B Wiota	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
11B*:				
Colo	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Good.
Ely	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
24D2 Shelby	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: thin layer, slope.
41C Sparta	Good	Probable	Improbable: too sandy.	Poor: thin layer.
43 Bremer	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
54 Zook	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey.
58D2 Douds	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones, slope.
58E2 Douds	Fair: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
65D, 65D2 Lindley	Fair: shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones, slope.
65E, 65E2, 65F, 65F2 Lindley	Fair: slope, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
65G Lindley	Poor: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
74 Rubio	Poor: shrink-swell, low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
75 Givin	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey.
76B, 76B2, 76C, 76C2, 76C3, 76D2, 76D3 Ladoga	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.

See footnote at end of table.

TABLE 13.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
80B, 80C, 80C2, 80C3, 80D, 80D2, 80D3: Clinton	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
87B*:				
Colo	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Good.
Zook	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey, thin layer.
88: Nevin	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
93D2*:				
Shelby	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: thin layer, slope.
Adair	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
93D3*:				
Shelby	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey, slope.
Adair	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
122: Sperry	Poor: low strength, wetness, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer, wetness.
133, 133+: Colo	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
163E, 163E2, 163E3, 163F: Fayette	Poor: low strength, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
163G: Fayette	Poor: low strength, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
175: Dickinson	Good	Probable	Improbable: too sandy.	Good.
179D2: Gara	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: slope, small stones.
179E2: Gara	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
180: Keomah	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: thin layer.

See footnote at end of table.

TABLE 13.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
192C2, 192D2: Adair	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
219: Jackson	Fair: wetness.	Probable	Improbable: too sandy.	Good.
220: Nodaway	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
222C2, 222C3: Clarinda	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey.
222D2, 222D3: Clarinda	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey, slope.
223C2, 223D2: Rinda	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
263: Okaw	Poor: low strength, wetness, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer, wetness.
264B: Ainsworth	Good	Probable	Improbable: too sandy.	Good.
269: Humeston	Poor: low strength, shrink-swell, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
279: Taintor	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey, thin layer.
280: Mahaska	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
281B, 281B2, 281C, 281C2, 281C3: Otley	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
281D2, 281D3: Otley	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: slope.
293E2*:				
Fayette	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
Lamont	Fair: slope.	Probable	Improbable: too sandy.	Poor: slope.
Chelsea	Fair: slope.	Probable	Improbable: too sandy.	Poor: slope.
294C2*:				
Ladoga	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.

See footnote at end of table.

TABLE 13.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
294C2*:				
Billett	Good	Probable	Improbable: too sandy.	Good.
294D2*:				
Ladoga	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
Billett	Good	Probable	Improbable: too sandy.	Fair: slope.
295C2*:				
Clinton	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
Lamont	Good	Probable	Improbable: too sandy.	Good.
Chelsea	Good	Probable	Improbable: too sandy.	Fair: too sandy.
295D2*, 295D3*:				
Clinton	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
Lamont	Good	Probable	Improbable: too sandy.	Fair: slope.
Chelsea	Good	Probable	Improbable: too sandy.	Fair: too sandy, slope.
422 Amana	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
424D*, 424D2*:				
Lindley	Fair: shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones, slope.
Keswick	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
424D3*:				
Lindley	Fair: shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey, small stones, slope.
Keswick	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
424E2*:				
Lindley	Fair: slope, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
Keswick	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer, slope.
425D2 Keswick	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.

See footnote at end of table.

TABLE 13.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
428B------------------ Ely	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
430------------------- Ackmore	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Good.
453------------------- Tuskeego	Poor: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer, wetness.
484------------------- Lawson	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
499F------------------ Nordness	Poor: area reclaim, thin layer, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, slope.
520, 520B------------- Coppock	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
539------------------- Perks	Good-----------------	Probable-------------	Improbable: too sandy.	Poor: too sandy.
570B, 570B2, 570C2, 570C3---------------- Nira	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
571B, 571B2, 571C2---- Hedrick	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
571C3----------------- Hedrick	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey.
572B, 572C2----------- Inton	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
592D2----------------- Mystic	Good-----------------	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
687B------------------ Watkins	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
688------------------- Koszta	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
715*:				
Nodaway--------------	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
Perks----------------	Good-----------------	Probable-------------	Improbable: too sandy.	Poor: too sandy.
729B*:				
Ackmore--------------	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Good.
Nodaway--------------	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
779------------------- Kalona	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey.

See footnote at end of table.

TABLE 13.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
792C2, 792D2 Armstrong	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
793B Bertrand	Good	Probable	Improbable: too sandy.	Good.
795D2 Ashgrove	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
876B, 876C2 Ladoga	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
880B, 880C2, 880D2 Clinton	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
881B Otley	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
993D2*:				
Gara	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: slope, small stones.
Armstrong	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
993D3*:				
Gara	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey, slope, small stones.
Armstrong	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
993E2*:				
Gara	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
Armstrong	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope, thin layer.
994D3*:				
Galland	Good	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
Douds	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones, slope.
1075 Givin	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey.
1180 Keomah	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: thin layer.
1280 Mahaska	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.

See footnote at end of table.

TABLE 13.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
1354*. Aquents				
1484 Lawson	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
2226 Elrin	Good	Probable	Improbable: too sandy.	Good.
2242*:				
Nodaway	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
Amana	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
5030*. Pits				
5040*. Orthents				

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 14.--WATER MANAGEMENT

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not evaluated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation]

Soil name and map symbol	Limitations for-- Pond reservoir areas	Limitations for-- Embankments, dikes, and levees	Limitations for-- Aquifer-fed excavated ponds	Features affecting-- Drainage	Features affecting-- Terraces and diversions	Features affecting-- Grassed waterways
7B Wiota	Moderate: seepage, slope.	Slight	Severe: no water.	Deep to water	Erodes easily	Erodes easily.
11B*:						
Colo	Moderate: seepage, slope.	Severe: wetness.	Moderate: slow refill.	Frost action, slope.	Wetness	Wetness.
Ely	Moderate: slope, seepage.	Moderate: wetness.	Moderate: deep to water, slow refill.	Slope, frost action.	Erodes easily, wetness.	Erodes easily.
24D2 Shelby	Severe: slope.	Slight	Severe: no water.	Deep to water	Slope	Slope.
41C Sparta	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Too sandy, soil blowing.	Droughty.
43 Bremer	Slight	Severe: wetness, hard to pack.	Severe: slow refill.	Frost action	Wetness	Wetness.
54 Zook	Slight	Severe: hard to pack, wetness.	Severe: slow refill.	Flooding, percs slowly, frost action.	Not needed	Not needed.
58D2, 58E2 Douds	Severe: seepage, slope.	Severe: piping.	Severe: cutbanks cave.	Deep to water	Slope, too sandy.	Slope.
65D, 65D2, 65E, 65E2, 65F, 65F2, 65G Lindley	Severe: slope.	Moderate: piping.	Severe: no water.	Deep to water	Slope	Slope.
74 Rubio	Slight	Severe: wetness.	Severe: no water.	Percs slowly, frost action.	Wetness, erodes easily.	Wetness, erodes easily, percs slowly.
75 Givin	Slight	Moderate: wetness, hard to pack.	Severe: slow refill.	Frost action	Wetness, erodes easily.	Erodes easily.
76B, 76B2, 76C, 76C2, 76C3 Ladoga	Moderate: seepage, slope.	Moderate: hard to pack.	Severe: no water.	Deep to water	Erodes easily	Erodes easily.
76D2, 76D3 Ladoga	Severe: slope.	Moderate: hard to pack.	Severe: no water.	Deep to water	Slope, erodes easily.	Slope, erodes easily.
80B, 80C, 80C2, 80C3 Clinton	Moderate: seepage, slope.	Moderate: hard to pack.	Severe: no water.	Deep to water	Erodes easily	Erodes easily.

See footnote at end of table.

TABLE 14.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Features affecting-- Drainage	Terraces and diversions	Grassed waterways
80D, 80D2, 80D3 Clinton	Severe: slope.	Moderate: hard to pack.	Severe: no water.	Deep to water	Slope, erodes easily.	Slope, erodes easily.
87B*:						
Colo	Moderate: seepage, slope.	Severe: wetness.	Moderate: slow refill.	Frost action, slope.	Wetness	Wetness.
Zook	Slight	Severe: hard to pack, wetness.	Severe: slow refill.	Percs slowly, frost action.	Wetness, percs slowly.	Wetness, percs slowly.
88 Nevin	Moderate: seepage.	Moderate: wetness.	Moderate: deep to water, slow refill.	Frost action	Erodes easily, wetness.	Erodes easily.
93D2*, 93D3*:						
Shelby	Severe: slope.	Slight	Severe: no water.	Deep to water	Slope	Slope.
Adair	Severe: slope.	Moderate: wetness.	Severe: no water.	Percs slowly, slope, frost action.	Slope, wetness.	Wetness, slope.
122 Sperry	Slight	Severe: ponding.	Severe: slow refill.	Ponding, percs slowly, frost action.	Erodes easily, ponding.	Wetness, erodes easily, percs slowly.
133, 133+ Colo	Moderate: seepage.	Severe: wetness.	Moderate: slow refill.	Flooding, frost action.	Wetness	Wetness.
163E, 163E2, 163E3, 163F, 163G Fayette	Severe: slope.	Slight	Severe: no water.	Deep to water	Slope, erodes easily.	Slope, erodes easily.
175 Dickinson	Severe: seepage.	Severe: seepage.	Severe: no water.	Deep to water	Soil blowing, too sandy.	Favorable.
179D2, 179E2 Gara	Severe: slope.	Slight	Severe: no water.	Deep to water	Slope	Slope.
180 Keomah	Slight	Severe: hard to pack.	Severe: slow refill.	Frost action, percs slowly.	Wetness, erodes easily, percs slowly.	Erodes easily, percs slowly.
192C2 Adair	Moderate: slope.	Moderate: wetness.	Severe: no water.	Percs slowly, slope, frost action.	Wetness	Wetness.
192D2 Adair	Severe: slope.	Moderate: wetness.	Severe: no water.	Percs slowly, slope, frost action.	Slope, wetness.	Wetness, slope.
219 Jackson	Moderate: seepage.	Moderate: thin layer, wetness.	Severe: cutbanks cave.	Frost action	Erodes easily, wetness.	Erodes easily.
220 Nodaway	Moderate: seepage.	Severe: piping.	Moderate: deep to water, slow refill.	Deep to water	Erodes easily	Erodes easily.

See footnote at end of table.

TABLE 14.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Features affecting-- Drainage	Terraces and diversions	Grassed waterways
222C2, 222C3------ Clarinda	Moderate: slope.	Severe: hard to pack.	Severe: no water.	Percs slowly, frost action, slope.	Erodes easily, wetness.	Wetness, erodes easily.
222D2, 222D3------ Clarinda	Severe: slope.	Severe: hard to pack.	Severe: no water.	Percs slowly, frost action, slope.	Slope, erodes easily, wetness.	Wetness, slope, erodes easily.
223C2------------ Rinda	Moderate: slope.	Severe: hard to pack.	Severe: no water.	Slope, percs slowly, frost action.	Erodes easily, wetness.	Erodes easily, wetness.
223D2------------ Rinda	Severe: slope.	Severe: hard to pack.	Severe: no water.	Slope, percs slowly, frost action.	Slope, wetness, erodes easily.	Wetness, slope, erodes easily.
263-------------- Okaw	Slight---------	Severe: hard to pack, ponding.	Severe: slow refill.	Ponding, percs slowly.	Erodes easily, ponding, percs slowly.	Wetness, erodes easily, percs slowly.
264B------------- Ainsworth	Moderate: seepage, slope.	Moderate: thin layer.	Severe: no water.	Deep to water	Erodes easily	Erodes easily.
269-------------- Humeston	Moderate: seepage.	Severe: wetness.	Severe: slow refill.	Percs slowly, frost action, flooding.	Wetness, percs slowly.	Percs slowly, wetness.
279-------------- Taintor	Moderate: seepage.	Severe: wetness.	Severe: slow refill.	Frost action---	Erodes easily, wetness.	Wetness, erodes easily.
280-------------- Mahaska	Moderate: seepage.	Moderate: wetness, hard to pack.	Moderate: deep to water, slow refill.	Frost action---	Wetness, erodes easily.	Erodes easily.
281B, 281B2, 281C, 281C2, 281C3----- Otley	Moderate: seepage, slope.	Moderate: hard to pack.	Severe: no water.	Deep to water	Erodes easily	Erodes easily.
281D2, 281D3------ Otley	Severe: slope.	Moderate: hard to pack.	Severe: no water.	Deep to water	Slope, erodes easily.	Slope, erodes easily.
293E2*:						
Fayette----------	Severe: slope.	Slight---------	Severe: no water.	Deep to water	Slope, erodes easily.	Slope, erodes easily.
Lamont-----------	Severe: seepage, slope.	Moderate: thin layer.	Severe: no water.	Deep to water	Slope, soil blowing.	Slope.
Chelsea----------	Severe: slope, seepage.	Severe: piping, seepage.	Severe: no water.	Deep to water	Slope, too sandy, soil blowing.	Slope, droughty.
294C2*:						
Ladoga-----------	Moderate: seepage, slope.	Moderate: hard to pack.	Severe: no water.	Deep to water	Erodes easily	Erodes easily.
Billett----------	Severe: seepage.	Severe: piping.	Severe: no water.	Deep to water	Too sandy, soil blowing.	Favorable.

See footnote at end of table.

TABLE 14.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Features affecting-- Drainage	Terraces and diversions	Grassed waterways
294D2*:						
Ladoga	Severe: slope.	Moderate: hard to pack.	Severe: no water.	Deep to water	Slope, erodes easily.	Slope, erodes easily.
Billett	Severe: seepage, slope.	Severe: piping.	Severe: no water.	Deep to water	Slope, too sandy, soil blowing.	Slope.
295C2*:						
Clinton	Moderate: seepage, slope.	Moderate: hard to pack.	Severe: no water.	Deep to water	Erodes easily	Erodes easily.
Lamont	Severe: seepage.	Moderate: thin layer.	Severe: no water.	Deep to water	Soil blowing	Favorable.
Chelsea	Severe: seepage.	Severe: piping, seepage.	Severe: no water.	Deep to water	Too sandy, soil blowing.	Droughty.
295D2*, 295D3*:						
Clinton	Severe: slope.	Moderate: hard to pack.	Severe: no water.	Deep to water	Slope, erodes easily.	Slope, erodes easily.
Lamont	Severe: seepage, slope.	Moderate: thin layer.	Severe: no water.	Deep to water	Slope, soil blowing.	Slope.
Chelsea	Severe: slope, seepage.	Severe: piping, seepage.	Severe: no water.	Deep to water	Slope, too sandy, soil blowing.	Slope, droughty.
422 Amana	Moderate: seepage.	Moderate: wetness.	Moderate: deep to water, slow refill.	Flooding, frost action.	Erodes easily, wetness.	Erodes easily.
424D*, 424D2*, 424D3*, 424E2*:						
Lindley	Severe: slope.	Moderate: piping.	Severe: no water.	Deep to water	Slope	Slope.
Keswick	Severe: slope.	Moderate: wetness.	Severe: no water.	Percs slowly, frost action, slope.	Slope, erodes easily, wetness.	Wetness, slope, erodes easily.
425D2 Keswick	Severe: slope.	Moderate: wetness.	Severe: no water.	Percs slowly, frost action, slope.	Slope, erodes easily, wetness.	Wetness, slope, erodes easily.
428B Ely	Moderate: slope, seepage.	Moderate: wetness.	Moderate: deep to water, slow refill.	Slope, frost action.	Erodes easily, wetness.	Erodes easily.
430 Ackmore	Moderate: seepage.	Severe: hard to pack, wetness.	Moderate: slow refill.	Flooding, frost action.	Wetness, erodes easily.	Wetness, erodes easily.
453 Tuskeego	Slight	Severe: thin layer, wetness.	Severe: slow refill.	Percs slowly	Wetness, percs slowly.	Wetness, percs slowly.

See footnote at end of table.

TABLE 14.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Features affecting-- Drainage	Terraces and diversions	Grassed waterways
484 Lawson	Moderate: seepage.	Severe: wetness.	Moderate: slow refill.	Flooding, frost action.	Erodes easily, wetness.	Wetness, erodes easily.
499F Nordness	Severe: slope, depth to rock.	Severe: thin layer.	Severe: no water.	Deep to water	Slope, depth to rock, erodes easily.	Slope, erodes easily, droughty.
520 Coppock	Moderate: seepage.	Severe: hard to pack, wetness.	Moderate: slow refill.	Flooding, frost action.	Wetness, erodes easily.	Wetness, erodes easily.
520B Coppock	Moderate: seepage, slope.	Severe: hard to pack, wetness.	Moderate: slow refill.	Frost action, slope.	Wetness, erodes easily.	Wetness, erodes easily.
539 Perks	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Too sandy, soil blowing.	Droughty, rooting depth.
570B, 570B2, 570C2, 570C3 Nira	Moderate: seepage, slope.	Moderate: hard to pack.	Moderate: deep to water, slow refill.	Deep to water	Erodes easily	Erodes easily.
571B, 571B2, 571C2, 571C3 Hedrick	Moderate: seepage, slope.	Moderate: hard to pack.	Moderate: deep to water, slow refill.	Deep to water	Erodes easily	Erodes easily.
572B, 572C2 Inton	Moderate: seepage, slope.	Moderate: hard to pack.	Moderate: deep to water, slow refill.	Deep to water	Erodes easily	Erodes easily.
592D2 Mystic	Severe: slope.	Moderate: thin layer, hard to pack.	Severe: no water.	Deep to water	Slope, erodes easily, percs slowly.	Slope, erodes easily, percs slowly.
687B Watkins	Moderate: seepage, slope.	Moderate: piping.	Severe: no water.	Deep to water	Erodes easily	Erodes easily.
688 Koszta	Moderate: seepage.	Moderate: wetness.	Moderate: deep to water, slow refill.	Frost action	Erodes easily, wetness.	Erodes easily.
715*:						
Nodaway	Moderate: seepage.	Severe: piping.	Moderate: deep to water, slow refill.	Deep to water	Erodes easily	Erodes easily.
Perks	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Too sandy, soil blowing.	Droughty, rooting depth.
729B*:						
Ackmore	Moderate: seepage, slope.	Severe: hard to pack, wetness.	Moderate: slow refill.	Flooding, slope, frost action.	Wetness, erodes easily.	Wetness, erodes easily.
Nodaway	Moderate: seepage.	Severe: piping.	Moderate: deep to water, slow refill.	Deep to water	Erodes easily	Erodes easily.

See footnote at end of table.

TABLE 14.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Features affecting-- Drainage	Terraces and diversions	Grassed waterways
779 Kalona	Slight	Severe: wetness.	Severe: slow refill.	Frost action	Wetness, erodes easily.	Wetness, erodes easily.
792C2 Armstrong	Moderate: slope.	Moderate: wetness, hard to pack.	Severe: no water.	Percs slowly, frost action, slope.	Percs slowly, wetness.	Percs slowly, wetness.
792D2 Armstrong	Severe: slope.	Moderate: wetness, hard to pack.	Severe: no water.	Percs slowly, frost action, slope.	Slope, percs slowly, wetness.	Percs slowly, slope, wetness.
793B Bertrand	Moderate: seepage, slope.	Moderate: thin layer, piping.	Severe: no water.	Deep to water	Erodes easily	Erodes easily.
795D2 Ashgrove	Severe: slope.	Moderate: hard to pack, wetness.	Severe: no water.	Percs slowly, frost action, slope.	Slope, erodes easily, wetness.	Wetness, slope, erodes easily.
876B, 876C2 Ladoga	Moderate: seepage, slope.	Moderate: hard to pack.	Severe: no water.	Deep to water	Erodes easily	Erodes easily.
880B, 880C2 Clinton	Moderate: seepage, slope.	Moderate: hard to pack.	Severe: no water.	Deep to water	Erodes easily	Erodes easily.
880D2 Clinton	Severe: slope.	Moderate: hard to pack.	Severe: no water.	Deep to water	Slope, erodes easily.	Slope, erodes easily.
881B Otley	Moderate: seepage, slope.	Moderate: hard to pack.	Severe: no water.	Deep to water	Erodes easily	Erodes easily.
993D2*, 993D3*, 993E2*:						
Gara	Severe: slope.	Slight	Severe: no water.	Deep to water	Slope	Slope.
Armstrong	Severe: slope.	Moderate: wetness, hard to pack.	Severe: no water.	Percs slowly, frost action, slope.	Slope, percs slowly, wetness.	Percs slowly, slope, wetness.
994D3*:						
Galland	Severe: slope.	Moderate: hard to pack, thin layer.	Severe: no water.	Deep to water	Slope, erodes easily, percs slowly.	Slope, erodes easily, rooting depth.
Douds	Severe: seepage, slope.	Severe: piping.	Severe: cutbanks cave.	Deep to water	Slope, too sandy.	Slope.
1075 Givin	Slight	Moderate: wetness, hard to pack.	Severe: slow refill.	Frost action	Wetness, erodes easily.	Erodes easily.
1180 Keomah	Slight	Severe: hard to pack.	Severe: slow refill.	Frost action, percs slowly.	Wetness, erodes easily, percs slowly.	Erodes easily, percs slowly.

See footnote at end of table.

TABLE 14.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Features affecting-- Drainage	Terraces and diversions	Grassed waterways
1280-------------- Mahaska	Moderate: seepage.	Moderate: wetness, hard to pack.	Moderate: deep to water, slow refill.	Frost action---	Wetness, erodes easily.	Erodes easily.
1354*. Aquents						
1484-------------- Lawson	Moderate: seepage.	Severe: wetness.	Moderate: slow refill.	Flooding, frost action.	Erodes easily, wetness.	Wetness, erodes easily.
2226-------------- Elrin	Severe: seepage.	Severe: seepage, piping.	Severe: cutbanks cave.	Deep to water	Too sandy------	Favorable.
2242*: Nodaway----------	Moderate: seepage.	Severe: piping.	Moderate: deep to water, slow refill.	Deep to water	Erodes easily	Erodes easily.
Amana------------	Moderate: seepage.	Moderate: wetness.	Moderate: deep to water, slow refill.	Flooding, frost action.	Erodes easily, wetness.	Erodes easily.
5030*. Pits						
5040*. Orthents						

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 15.--ENGINEERING INDEX PROPERTIES

[The symbol < means less than; > means more than. Absence of an entry indicates that data were not estimated]

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments > 3 inches	Percentage passing sieve number-- 4	10	40	200	Liquid limit	Plasticity index
	In				Pct					Pct	
7B---------------- Wiota	0-19	Silty clay loam	CL	A-6	0	100	100	100	90-95	30-40	10-20
	19-51	Silty clay loam	CL	A-7	0	100	100	95-100	90-95	40-50	15-25
	51-60	Silty clay loam, silt loam.	CL	A-7	0	100	100	95-100	90-95	40-50	20-30
11B*:											
Colo--------------	0-20	Silty clay loam	CL, CH	A-7	0	100	100	90-100	90-100	40-60	15-30
	20-47	Silty clay loam	CL, CH	A-7	0	100	100	90-100	90-100	40-55	20-30
	47-60	Silty clay loam, clay loam, silt loam.	CL, CH	A-7	0	100	100	95-100	80-100	40-55	15-30
Ely---------------	0-37	Silty clay loam	CL, OL, OH, MH	A-7, A-6	0	100	100	95-100	95-100	30-55	10-25
	37-50	Silty clay loam	CL, ML	A-7, A-6	0	100	100	95-100	95-100	35-50	10-25
	50-60	Silt loam, silty clay loam, loam.	CL	A-6	0	100	100	90-100	85-100	25-40	10-20
24D2-------------- Shelby	0-10	Loam--------------	CL	A-6	0	95-100	85-95	75-90	55-70	30-40	10-20
	10-51	Clay loam---------	CL	A-6, A-7	0-5	90-95	85-95	75-90	55-70	30-45	15-25
	51-60	Clay loam---------	CL	A-6, A-7	0-5	90-95	85-95	75-90	55-70	30-45	15-25
41C--------------- Sparta	0-23	Loamy fine sand	SM	A-2, A-4	0	85-100	85-100	50-95	15-50	---	NP
	23-38	Loamy fine sand, fine sand, sand.	SP-SM, SM	A-2, A-3, A-4	0	85-100	85-100	50-95	5-50	---	NP
	38-60	Sand, fine sand	SP-SM, SM, SP	A-2, A-3	0	85-100	85-100	50-95	2-30	---	NP
43---------------- Bremer	0-21	Silty clay loam	CH, CL	A-7	0	100	100	100	95-100	45-60	25-40
	21-41	Silty clay loam silty clay.	CH, MH	A-7	0	100	100	100	95-100	50-65	20-35
	41-60	Silty clay loam	CH, CL	A-7	0	100	100	100	95-100	40-60	25-40
54---------------- Zook	0-6	Silty clay loam	CH, CL	A-7	0	100	100	95-100	95-100	45-65	20-35
	6-60	Silty clay, silty clay loam.	CH	A-7	0	100	100	95-100	95-100	60-85	35-55
58D2, 58E2-------- Douds	0-10	Loam--------------	CL	A-6	0	95-100	85-100	70-90	60-80	25-35	10-20
	10-38	Clay loam, loam sandy clay loam.	CL, SC	A-6, A-7	0	95-100	85-100	70-80	35-60	30-45	15-25
	38-60	Stratified loamy sand to clay loam.	SC, CL SM-SC, CL-ML	A-4, A-6, A-2	0	90-100	85-100	65-85	20-60	15-35	5-15
65D, 65D2, 65E, 65E2, 65F, 65F2, 65G-------------- Lindley	0-6	Loam--------------	CL	A-6	0	95-100	90-100	85-95	50-65	25-35	10-15
	6-49	Clay loam, loam	CL	A-6, A-7	0	95-100	90-100	85-95	55-75	30-45	12-20
	49-60	Loam, clay loam	CL	A-6	0	95-100	90-100	85-95	50-70	25-35	10-15
74---------------- Rubio	0-8	Silt loam---------	CL, CL-ML	A-6, A-4	0	100	100	100	95-100	25-40	5-15
	8-16	Silt loam---------	CL-ML, CL, ML	A-4	0	100	100	100	95-100	25-35	5-10
	16-40	Silty clay, silty clay loam.	CH	A-7	0	100	100	100	95-100	55-70	30-40
	40-60	Silty clay loam	CH, CL	A-7	0	100	100	100	95-100	45-55	20-30
75---------------- Givin	0-13	Silt loam---------	CL, ML	A-4, A-6	0	100	100	100	95-100	30-40	5-15
	13-49	Silty clay loam, silty clay.	CL, CH	A-7	0	100	100	100	95-100	45-60	25-35
	49-60	Silty clay loam	CL	A-6, A-7	0	100	100	100	95-100	35-50	20-30

See footnote at end of table.

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
76B, 76B2, 76C, 76C2------------ Ladoga	0-8	Silt loam--------	CL, CL-ML	A-6, A-4	0	100	100	100	95-100	25-40	5-15
	8-39	Silty clay loam, silty clay.	CL, CH	A-7	0	100	100	100	95-100	40-55	25-35
	39-60	Silty clay loam, silt loam.	CL	A-6	0	100	100	100	95-100	30-40	15-20
76C3------------- Ladoga	0-7	Silty clay loam	CL, CL-ML	A-6, A-4	0	100	100	100	95-100	25-40	5-15
	7-37	Silty clay loam, silty clay.	CL, CH	A-7	0	100	100	100	95-100	40-55	25-35
	37-60	Silty clay loam, silt loam.	CL	A-6	0	100	100	100	95-100	30-40	15-20
76D2------------- Ladoga	0-8	Silt loam--------	CL, CL-ML,	A-6, A-4	0	100	100	100	95-100	25-40	5-15
	8-39	Silty clay loam, silty clay.	CL, CH	A-7	0	100	100	100	95-100	40-55	25-35
	39-60	Silty clay loam, silt loam.	CL	A-6	0	100	100	100	95-100	30-40	15-20
76D3------------- Ladoga	0-7	Silty clay loam	CL, CL-ML	A-6, A-4	0	100	100	100	95-100	25-40	5-15
	7-37	Silty clay loam, silty clay.	CL, CH	A-7	0	100	100	100	95-100	40-55	25-35
	37-60	Silty clay loam, silt loam.	CL	A-6	0	100	100	100	95-100	30-40	15-20
80B, 80C, 80C2--- Clinton	0-8	Silt loam--------	ML	A-4	0	100	100	100	95-100	30-40	5-10
	8-37	Silty clay loam, silty clay.	CL, CH	A-7	0	100	100	100	95-100	40-55	25-35
	37-60	Silty clay loam, silt loam.	CL	A-6, A-7	0	100	100	100	95-100	35-45	15-25
80C3------------- Clinton	0-7	Silty clay loam	CL	A-6, A-7	0	100	100	100	95-100	35-45	15-25
	7-43	Silty clay loam, silty clay.	CL, CH	A-7	0	100	100	100	95-100	40-55	25-35
	43-60	Silty clay loam, silt loam.	CL	A-6, A-7	0	100	100	100	95-100	35-45	15-25
80D, 80D2-------- Clinton	0-8	Silt loam--------	ML	A-4	0	100	100	100	95-100	30-40	5-10
	8-37	Silty clay loam, silty clay.	CL, CH	A-7	0	100	100	100	95-100	40-55	25-35
	37-60	Silty clay loam, silt loam.	CL	A-6, A-7	0	100	100	100	95-100	35-45	15-25
80D3------------- Clinton	0-7	Silty clay loam	CL	A-6, A-7	0	100	100	100	95-100	35-45	15-25
	7-43	Silty clay loam, silty clay.	CL, CH	A-7	0	100	100	100	95-100	40-55	25-35
	43-60	Silty clay loam, silt loam.	CL	A-6, A-7	0	100	100	100	95-100	35-45	15-25
87B*:											
Colo------------	0-20	Silty clay loam	CL, CH	A-7	0	100	100	90-100	90-100	40-60	15-30
	20-47	Silty clay loam	CL, CH	A-7	0	100	100	90-100	90-100	40-55	20-30
	47-60	Silty clay loam, clay loam, silt loam.	CL, CH	A-7	0	100	100	95-100	80-100	40-55	15-30
Zook------------	0-6	Silty clay loam	CH, CL	A-7	0	100	100	95-100	95-100	45-65	20-35
	6-60	Silty clay, silty clay loam.	CH	A-7	0	100	100	95-100	95-100	60-85	35-55
88--------------- Nevin	0-20	Silty clay loam	CL, OL	A-6, A-7	0	100	100	100	90-95	35-45	10-20
	20-50	Silty clay loam	CL	A-7	0	100	100	95-100	90-95	40-50	20-30
	50-60	Silty clay loam, silt loam.	CL	A-7	0	100	100	95-100	90-95	40-50	20-30

See footnote at end of table.

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag- ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
93D2*:											
Shelby----------	0-10	Loamy------------	CL	A-6,	0	95-100	85-95	75-90	55-70	30-40	10-20
	10-51	Clay loam--------	CL	A-6, A-7	0-5	90-95	85-95	75-90	55-70	30-45	15-25
	51-60	Clay loam--------	CL	A-6, A-7	0-5	90-95	85-95	75-90	55-70	30-45	15-25
Adair-----------	0-10	Silty clay loam	CL	A-6	0	95-100	80-95	75-90	60-80	30-40	10-20
	10-35	Silty clay, clay, clay loam.	CL, CH	A-7	0	95-100	80-95	70-90	55-80	40-55	20-30
	35-60	Clay loam--------	CL	A-6, A-7	0	95-100	80-95	70-90	55-80	35-50	15-25
93D3*:											
Shelby----------	0-7	Clay loam--------	CL	A-6, A-7	0	90-95	85-95	75-90	55-70	35-45	15-25
	7-42	Clay loam--------	CL	A-6, A-7	0-5	90-95	85-95	75-90	55-70	30-45	15-25
	42-60	Clay loam--------	CL	A-6, A-7	0-5	90-95	85-95	75-90	55-70	30-45	15-25
Adair-----------	0-7	Clay loam--------	CL	A-6	0	95-100	80-95	75-90	60-80	30-40	10-20
	7-42	Silty clay, clay, clay loam.	CL, CH	A-7	0	95-100	80-95	70-90	55-80	40-55	20-30
	42-60	Clay loam--------	CL	A-6, A-7	0	95-100	80-95	70-90	55-80	35-50	15-25
122-------------- Sperry	0-13	Silt loam--------	CL	A-6	0	100	100	100	95-100	30-40	10-20
	13-44	Silty clay loam, silty clay.	CH	A-7	0	100	100	100	95-100	50-65	25-35
	44-60	Silty clay loam, silt loam.	CL	A-7	0	100	100	100	95-100	40-50	20-30
133-------------- Colo	0-20	Silty clay loam	CL, CH	A-7	0	100	100	90-100	90-100	40-60	15-30
	20-47	Silty clay loam	CL, CH	A-7	0	100	100	90-100	90-100	40-55	20-30
	47-60	Silt clay loam, clay loam, silt loam.	CL, CH	A-7	0	100	100	95-100	80-100	40-55	15-30
133+------------- Colo	0-12	Silt loam--------	CL, CL-ML	A-4, A-6	0	100	100	95-100	95-100	25-40	5-15
	12-52	Silty clay loam	CL, CH	A-7	0	100	100	90-100	90-100	40-55	20-30
	52-60	Silty clay loam, clay loam, silt loam.	CL, CH	A-7	0	100	100	95-100	80-100	40-55	15-30
163E, 163E2------ Fayette	0-15	Silt loam--------	CL-ML, CL	A-4, A-6	0	100	100	100	95-100	25-35	5-15
	15-51	Silty clay loam, silt loam.	CL	A-6, A-7	0	100	100	100	95-100	35-45	15-25
	51-60	Silt loam--------	CL	A-6	0	100	100	100	95-100	30-40	10-20
163E3------------ Fayette	0-7	Silty clay loam	CL	A-6, A-7	0	100	100	100	95-100	35-45	15-25
	7-37	Silty clay loam, silt loam.	CL	A-6, A-7	0	100	100	100	95-100	35-45	15-25
	37-60	Silt loam--------	CL	A-6	0	100	100	100	95-100	30-40	10-20
163F, 163G------- Fayette	0-15	Silt loam--------	CL-ML, CL	A-4, A-6	0	100	100	100	95-100	25-35	5-15
	15-51	Silty clay loam, silt loam.	CL	A-6, A-7	0	100	100	100	95-100	35-45	15-25
	51-60	Silt loam--------	CL	A-6	0	100	100	100	95-100	30-40	10-20
175-------------- Dickinson	0-8	Sandy loam-------	SM, SC, SM-SC	A-4, A-2	0	100	100	85-95	30-50	15-30	NP-10
	8-38	Fine sandy loam, sandy loam.	SM, SC, SM-SC,	A-4,	0	100	100	85-95	35-50	15-30	NP-10
	38-60	Loamy sand, loamy fine sand, sand.	SM, SP-SM, SM-SC	A-2, A-3	0	100	100	80-95	5-20	10-20	NP-5
179D2, 179E2----- Gara	0-12	Loam-------------	CL, CL-ML	A-4, A-6	0	95-100	85-95	75-85	55-70	20-30	5-15
	12-51	Clay loam, loam	CL	A-6	0-5	90-95	85-95	70-85	55-75	30-40	15-25
	51-60	Loam, clay loam	CL	A-6, A-7	0-5	90-95	85-95	70-85	55-75	35-45	15-25

See footnote at end of table.

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag- ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
180 Keomah	0-12	Silt loam	CL-ML, CL	A-4, A-6	0	100	100	100	95-100	25-35	5-15
	12-37	Silty clay loam, silty clay.	CH, CL	A-7	0	100	100	100	95-100	45-60	30-45
	37-60	Silty clay loam	CL	A-7, A-6	0	100	100	100	95-100	35-50	15-30
192C2, 192D2 Adair	0-10	Silty clay loam	CL	A-6,	0	95-100	80-95	75-90	60-80	30-40	10-20
	10-35	Silty clay, clay, clay loam.	CL, CH,	A-7	0	95-100	80-95	70-90	55-80	40-55	20-30
	35-60	Clay loam	CL	A-6, A-7	0	95-100	80-95	70-90	55-80	35-50	15-25
219 Jackson	0-12	Silt loam	CL, CL-ML	A-4, A-6	0	100	100	90-100	85-95	25-35	5-15
	12-19	Silt loam	CL	A-4, A-6	0	100	100	90-100	85-95	25-35	7-15
	19-40	Silt loam, silty clay loam.	CL	A-6, A-4	0	100	100	90-100	85-95	25-40	7-20
	40-60	Stratified silt loam to sand.	SC, SM, CL, ML	A-4	0	100	100	85-95	35-75	<30	4-10
220 Nodaway	0-60	Silt loam	CL, CL-ML	A-4, A-6	0	100	95-100	95-100	90-100	25-35	5-15
222C2 Clarinda	0-11	Silty clay loam	CL	A-7	0	100	95-100	90-100	85-100	40-50	20-30
	11-39	Silty clay, clay	CH	A-7	0	100	95-100	85-100	80-100	55-70	30-40
	39-60	Clay, silty clay	CH	A-7	0	95-100	95-100	80-95	75-90	55-70	35-45
222C3 Clarinda	0-8	Silty clay loam	CL	A-7	0	100	95-100	90-100	85-100	40-50	20-30
	8-35	Silty clay, clay	CH	A-7	0	100	95-100	85-100	80-100	55-70	30-40
	35-60	Clay, silty clay	CH	A-7	0	95-100	95-100	80-95	75-90	55-70	35-45
222D2 Clarinda	0-11	Silty clay loam	CL	A-7	0	100	95-100	90-100	85-100	40-50	20-30
	11-39	Silty clay, clay	CH	A-7	0	100	95-100	85-100	80-100	55-70	30-40
	39-60	Clay, silty clay	CH	A-7	0	95-100	95-100	80-95	75-90	55-70	35-45
222D3 Clarinda	0-8	Silty clay loam	CL	A-7	0	100	95-100	90-100	85-100	40-50	20-30
	8-36	Silty clay, clay	CH	A-7	0	100	95-100	85-100	80-100	55-70	30-40
	36-60	Clay, silty clay	CH	A-7	0	95-100	95-100	80-95	75-90	55-70	35-45
223C2, 223D2 Rinda	0-9	Silty clay loam	CL	A-7	0	100	95-100	90-100	85-100	40-50	20-30
	9-60	Clay, silty clay	CH	A-7	0	95-100	95-100	80-95	75-90	55-70	35-45
263 Okaw	0-16	Silt loam	CL, CL-ML,	A-4, A-6	0	100	100	95-100	90-100	25-40	5-15
	16-37	Silty clay, clay, silty clay loam.	CH	A-7	0	100	95-100	95-100	85-100	50-70	30-50
	37-45	Silty clay loam, silty clay, clay.	CL	A-7	0	100	100	95-100	80-100	45-65	20-40
	45-60	Silty clay loam, silty clay, clay.	CL	A-7	0	100	100	95-100	80-100	45-65	20-35
264B Ainsworth	0-9	Silt loam	ML	A-4,	0	100	100	100	90-95	30-40	5-10
	9-43	Silty clay loam	CL, CH	A-7	0	100	100	95-100	80-95	40-55	20-35
	43-60	Sandy loam, loamy sand, sand.	SP-SM, SM	A-2, A-3	0	95-100	95-100	60-85	5-35	<20	NP
269 Humeston	0-12	Silty clay loam	CL, CL-ML	A-6, A-4	0	100	100	95-100	95-100	25-40	5-15
	12-20	Silt loam	CL, CL-ML	A-6, A-4	0	100	100	95-100	95-100	25-40	5-15
	20-60	Silty clay loam, silty clay.	CH, CL	A-7	0	100	100	95-100	95-100	45-55	25-35

See footnote at end of table.

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag- ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
279--------------- Taintor	0-17	Silty clay loam	CL, CH	A-7	0	100	100	100	95-100	45-60	20-30
	17-40	Silty clay, silty clay loam.	CH	A-7	0	100	100	100	95-100	50-65	25-35
	40-60	Silty clay loam, silt loam.	CL	A-7	0	100	100	100	95-100	40-50	15-25
280--------------- Mahaska	0-17	Silty clay loam	CL	A-7, A-6	0	100	100	100	95-100	35-50	15-25
	17-42	Silty clay loam, silty clay.	CH, MH	A-7	0	100	100	100	95-100	50-60	20-30
	42-60	Silty clay loam, silt loam.	CL	A-7, A-6	0	100	100	100	95-100	35-45	15-20
281B, 281B2, 281C, 281C2----- Otley	0-18	Silty clay loam	CL	A-7	0	100	100	100	95-100	40-50	15-25
	18-39	Silty clay loam, silty clay.	CL, CH	A-7	0	100	100	100	95-100	40-55	25-35
	39-60	Silty clay loam, silt loam.	CL	A-7, A-6	0	100	100	100	95-100	35-45	20-30
281C3------------ Otley	0-8	Silty clay loam	CL	A-7	0	100	100	100	95-100	40-50	15-25
	8-39	Silty clay loam, silty clay.	CL, CH	A-7	0	100	100	100	95-100	40-55	25-35
	39-60	Silty clay loam, silt loam.	CL	A-7, A-6	0	100	100	100	95-100	35-45	20-30
281D2------------ Otley	0-18	Silty clay loam	CL	A-7	0	100	100	100	95-100	40-50	15-25
	18-39	Silty clay loam, silty clay.	CL, CH	A-7	0	100	100	100	95-100	40-55	25-35
	39-60	Silty clay loam, silt loam.	CL	A-7, A-6	0	100	100	100	95-100	35-45	20-30
281D3------------ Otley	0-8	Silty clay loam	CL	A-7	0	100	100	100	95-100	40-50	15-25
	8-39	Silty clay loam, silty clay.	CL, CH	A-7	0	100	100	100	95-100	40-55	25-35
	39-60	Silty clay loam, silt loam.	CL	A-7, A-6	0	100	100	100	95-100	35-45	20-30
293E2*: Fayette----------	0-15	Silt loam--------	CL-ML, CL	A-4, A-6	0	100	100	100	95-100	25-35	5-15
	15-51	Silty clay loam, silt loam.	CL	A-6, A-7	0	100	100	100	95-100	35-45	15-25
	51-60	Silt loam--------	CL	A-6	0	100	100	100	95-100	30-40	10-20
Lamont-----------	0-10	Fine sandy loam	SM-SC, SC	A-2, A-4	0	100	100	80-95	25-50	15-25	5-10
	10-30	Fine sandy loam, loam, sandy clay loam.	SM-SC, SC	A-2, A-4	0	100	100	85-95	30-50	20-30	5-10
	30-60	Loamy fine sand, loamy sand, sand.	SM, SP-SM	A-2, A-3	0	100	100	70-90	5-25	---	NP
Chelsea----------	0-7	Loam fine sand	SM, SP-SM	A-2-4	0	100	100	65-80	10-35	---	NP
	7-60	Fine sand, sand, loamy sand.	SP, SM, SP-SM,	A-3, A-2-4	0	100	100	65-80	3-15	---	NP
294C2*, 294D2*: Ladoga-----------	0-8	Silt loam--------	CL, CL-ML	A-6, A-4	0	100	100	100	95-100	25-40	5-15
	8-39	Silty clay loam, silty clay.	CL, CH	A-7	0	100	100	100	95-100	40-55	25-35
	39-60	Silty clay loam, silt loam.	CL	A-6	0	100	100	100	95-100	30-40	15-20

See footnote at end of table.

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification Unified	Classification AASHTO	Frag- ments > 3 inches	Percentage passing sieve number-- 4	10	40	200	Liquid limit	Plas- ticity index
	In				Pct					Pct	
294C2*, 294D2*:											
Billett	0-8	Sandy loam	SM, SM-SC SC	A-2, A-4	0	100	100	85-100	25-50	<25	2-10
	8-40	Sandy loam, fine sandy loam.	SM-SC, SC	A-2, A-4, A-6	0	100	100	85-100	25-50	20-30	5-15
	40-60	Loamy sand, sandy loam, fine sandy loam, sand.	SM, SM-SC, SC	A-2, A-4, A-6	0	95-100	85-100	75-90	20-45	15-30	3-15
295C2*, 295D2*:											
Clinton	0-8	Silt loamm	ML	A-4	0	100	100	100	95-100	30-40	5-10
	8-37	Silty clay loam, silty clay.	CL, CH,	A-7	0	100	100	100	95-100	40-55	25-35
	37-60	Silty clay loam, silt loam.	CL	A-6, A-7	0	100	100	100	95-100	35-45	15-25
Lamont	0-10	Fine sandy loam	SM-SC, SC	A-2, A-4	0	100	100	80-95	25-50	15-25	5-10
	10-30	Fine sandy loam, loam, sandy clay loam.	SM-SC, SC	A-2, A-4	0	100	100	85-95	30-50	20-30	5-10
	30-60	Loamy fine sand, loamy sand, sand.	SM, SP-SM	A-2, A-3	0	100	100	70-90	5-25	---	NP
Chelsea	0-7	Loamy fine sand	SM, SP-SM	A-2-4	0	100	100	65-80	10-35	---	NP
	7-60	Fine sand, sand, loamy sand.	SP, SM, SP-SM	A-3, A-2-4	0	100	100	65-80	3-15	---	NP
295D3*:											
Clinton	0-7	Silty clay loam	CL	A-6, A-7	0	100	100	95-100	35-45	35-45	15-25
	7-43	Silty clay loam, silty clay.	CL, CH	A-7	0	100	100	95-100	40-55	30-40	25-35
	43-60	Silty clay loam, silt loam.	CL	A-6, A-7,	0	100	100	95-100	35-45	35-45	15-25
Lamont	0-7	Fine sandy loam	SM-SC, SC	A-2, A-4	0	100	100	80-95	25-50	15-25	5-10
	7-24	Fine sandy loam, loam, sandy clay loam.	SM-SC, SC	A-2, A-4	0	100	100	85-95	30-50	20-30	5-10
	24-60	Loamy fine sand, loamy sand, sand.	SM, SP-SM,	A-2, A-3,	0	100	100	70-90	5-25	---	NP
Chelsea	0-7	Loamy fine sand	SM, SP-SM	A-2-4	0	100	100	65-80	10-35	---	NP
	7-60	Fine sand, sand, loamy sand.	SP, SM, SP-SM	A-3, A-2-4	0	100	100	65-80	3-15	---	NP
422 Amana	0-16	Silt loam	CL	A-6	0	100	100	95-100	90-95	25-40	10-20
	16-48	Silt loam, silty clay loam.	CL	A-6, A-7	0	100	100	95-100	90-95	35-45	15-25
	48-60	Silt loam	CL	A-6	0	100	100	95-100	75-95	30-40	10-20
424D*, 424D2*:											
Lindley	0-6	Loam	CL	A-6	0	95-100	90-100	85-95	50-65	25-35	10-15
	6-49	Clay loam, loam	CL	A-6, A-7	0	95-100	90-100	85-95	55-75	30-45	12-20
	49-60	Loam, clay loam	CL	A-6	0	95-100	90-100	85-95	50-70	25-35	10-15
Keswick	0-8	Silt loam, silty clay loam.	CL, CL-ML	A-6, A-4	0-5	90-100	80-100	75-90	60-80	20-30	5-15
	8-28	Clay loam, clay	CH, MH	A-7	0-5	90-100	80-100	70-90	55-80	50-60	20-30
	28-60	Clay loam	CL	A-6	0-5	90-100	80-100	70-90	55-80	30-40	15-25

See footnote at end of table.

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag- ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
424D3*:											
Lindley----------	0-4	Clay loam--------	CL	A-6	0	95-100	90-100	85-95	55-75	30-40	15-20
	4-40	Clay loam, loam	CL	A-6, A-7	0	95-100	90-100	85-95	55-75	30-45	12-20
	40-60	Loam, clay loam	CL	A-6	0	95-100	90-100	85-95	50-70	25-35	10-15
Keswick----------	0-4	Clay loam--------	CL	A-6, A-7	0-5	90-100	80-100	75-90	60-80	35-45	15-25
	4-18	Clay loam, clay	CH, MH	A-7	0-5	90-100	80-100	70-90	55-80	50-60	20-30
	18-60	Clay loam--------	CL	A-6	0-5	90-100	80-100	70-90	55-80	30-40	15-25
424E2*:											
Lindley----------	0-6	Loam-------------	CL	A-6	0	95-100	90-100	85-95	50-65	25-35	10-15
	6-49	Clay loam, loam	CL	A-6, A-7	0	95-100	90-100	85-95	55-75	30-45	12-20
	49-60	Loam, clay loam	CL	A-6	0	95-100	90-100	85-95	50-70	25-35	10-15
Keswick----------	0-8	Silt loam, silty clay loam.	CL, CL-ML	A-6, A-4	0-5	90-100	80-100	75-90	60-80	20-30	5-15
	8-28	Clay loam, clay	CH, MH	A-7	0-5	90-100	80-100	70-90	55-80	50-60	20-30
	28-60	Clay loam--------	CL	A-6	0-5	90-100	80-100	70-90	55-80	30-40	15-25
425D2------------- Keswick	0-8	Silt loam--------	CL, CL-ML	A-6, A-4	0-5	90-100	80-100	75-90	60-80	20-30	5-15
	8-28	Clay loam, clay	CH, MH	A-7	0-5	90-100	80-100	70-90	55-80	50-60	20-30
	28-60	Clay loam--------	CL	A-6	0-5	90-100	80-100	70-90	55-80	30-40	15-25
428B-------------- Ely	0-37	Silty clay loam	CL, OL, OH, MH	A-7, A-6	0	100	100	95-100	95-100	30-55	10-25
	37-50	Silty clay loam	CL, ML	A-7, A-6	0	100	100	95-100	95-100	35-50	10-25
	50-60	Silt loam, silty clay loam, loam.	CL	A-6	0	100	100	90-100	85-100	25-40	10-20
430--------------- Ackmore	0-26	Silt loam--------	CL, ML	A-4, A-6 A-7	0	100	100	95-100	85-100	25-50	8-20
	26-60	Silty clay loam, silt loam.	CH, CL, MH, ML	A-7, A-6	0	100	100	95-100	85-100	35-60	15-30
453--------------- Tuskeego	0-9	Silt loam--------	CL, CL-ML	A-4, A-6	0	100	100	98-100	95-100	25-35	5-15
	9-30	Silty clay loam, silty clay.	CH	A-7	0	100	100	98-100	95-100	50-60	25-35
	30-60	Silty clay loam	CH, CL	A-7	0	100	100	98-100	95-100	45-55	25-35
484--------------- Lawson	0-34	Silt loam--------	CL, CL-ML	A-4	0	100	100	90-100	80-100	20-30	5-10
	34-60	Silty clay loam, silt loam.	CL	A-6	0	100	100	90-100	80-100	20-40	10-25
499F-------------- Nordness	0-8	Silt loam--------	CL, CL-ML	A-4	0	100	100	90-100	70-90	20-30	5-10
	8-13	Silt loam, silty clay loam, loam.	CL	A-6, A-7	0	100	100	90-100	70-90	35-45	15-25
	13-17	Silty clay loam, clay.	CL, CH	A-7	2-10	85-95	80-90	70-85	65-85	45-60	30-40
	17	Unweathered bedrock, weathered bedrock.	---	---	---	---	---	---	---	---	---
520, 520B--------- Coppock	0-7	Silt loam--------	CL	A-6	0	100	100	98-100	95-100	30-40	10-20
	7-26	Silt loam--------	CL	A-6	0	100	100	98-100	95-100	30-40	10-20
	26-50	Silty clay loam, silt loam.	CL, CH, MH	A-6, A-7	0	100	100	98-100	95-100	35-55	15-25
	50-60	Silty clay loam	CL, CH	A-7	0	100	100	98-100	95-100	40-60	15-30
539--------------- Perks	0-8	Sandy loam-------	SM, SM-SC, SC	A-4	0	100	100	75-80	35-50	15-30	NP-10
	8-60	Sand, loamy sand, sandy loam.	SM, SP, SP-SM	A-1	0	90-100	90-95	30-50	3-20	---	NP

See footnote at end of table.

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag- ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
570B, 570B2, 570C2----------- Nira	0-12	Silty clay loam	CL, CH	A-7	0	100	100	100	95-100	40-55	15-25
	12-43	Silty clay loam	CL, CH	A-7	0	100	100	100	95-100	40-55	20-30
	43-60	Silty clay loam, silt loam.	CL	A-6, A-7	0	100	100	100	95-100	35-45	15-25
570C3------------ Nira	0-8	Silty clay loam	CL, CH	A-7	0	100	100	100	95-100	40-55	15-25
	8-33	Silty clay loam	CL, CH	A-7	0	100	100	100	95-100	40-55	20-30
	33-60	Silty clay loam, silt loam.	CL	A-6, A-7	0	100	100	100	95-100	35-45	15-25
571B, 571B2, 571C2----------- Hedrick	0-8	Silt loam--------	CL, CL-ML	A-6, A-4	0	100	100	100	95-100	25-40	5-15
	8-38	Silty clay loam	CL, CH	A-7	0	100	100	100	95-100	40-55	25-35
	38-60	Silty clay loam, silt loam.	CL	A-6	0	100	100	100	95-100	30-40	15-20
571C3------------ Hedrick	0-7	Silty clay loam	CL	A-6, A-7	0	100	100	100	95-100	35-45	15-25
	7-30	Silty clay loam	CL, CH	A-7	0	100	100	100	95-100	40-55	25-35
	30-60	Silty clay loam, silt loam.	CL	A-6	0	100	100	100	95-100	30-40	15-20
572B, 572C2------ Inton	0-5	Silt loam--------	ML	A-4	0	100	100	100	95-100	30-40	5-10
	5-49	Silty clay loam	CL, CH	A-7	0	100	100	100	95-100	40-55	25-35
	49-60	Silty clay loam, silt loam.	CL	A-6	0	100	100	100	95-100	30-40	15-25
592D2------------ Mystic	0-7	Loam-------------	CL	A-6, A-7	0	100	100	80-100	65-90	30-45	10-25
	7-33	Clay loam, clay, silty clay.	CL, CH	A-7	0	100	90-100	80-100	65-80	40-55	25-35
	33-56	Sandy clay loam, loam.	SC, CL, SM-SC, CL-ML	A-6, A-4	0-5	90-100	80-100	70-95	40-65	25-40	5-20
	56-60	Stratified sandy loam to clay.	SM-SC, SC, CL-ML, CL	A-4, A-2, A-6	0-5	90-100	80-100	65-95	30-60	20-35	5-15
687B------------- Watkins	0-14	Silt loam--------	CL, CL-ML	A-6, A-4	0	100	100	95-100	85-95	25-35	5-15
	14-49	Silty clay loam, silt loam.	CL, ML	A-6, A-7	0	100	100	95-100	85-95	35-45	10-20
	49-60	Silty clay loam, silt loam, loam.	CL	A-6	0	100	100	95-100	85-95	30-40	10-20
688-------------- Koszta	0-14	Silt loam--------	CL	A-6	0	100	100	95-100	95-100	30-40	10-20
	14-60	Silty clay loam	CL	A-7	0	100	100	95-100	95-100	40-50	20-30
715*:											
Nodaway---------	0-60	Silt loam--------	CL, CL-ML	A-4, A-6	0	100	95-100	95-100	90-100	25-35	5-15
Perks-----------	0-8	Sandy loam-------	SM, SM-SC, SC	A-4	0	100	100	75-80	35-50	15-30	NP-10
	8-60	Sand, loamy sand, sandy loam.	SM, SP, SP-SM	A-1	0	90-100	90-95	30-50	3-20	---	NP
729B*:											
Ackmore---------	0-26	Silt loam--------	CL, ML	A-4, A-6, A-7	0	100	100	95-100	85-100	25-50	8-20
	26-60	Silty clay loam, silt loam.	CH, CL MH, ML	A-7, A-6	0	100	100	95-100	85-100	35-60	15-30
Nodaway---------	0-60	Silt loam--------	CL, CL-ML	A-4, A-6	0	100	95-100	95-100	90-100	25-35	5-15

See footnote at end of table.

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag- ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
779-------------- Kalona	0-19	Silty clay loam	MH	A-7	0	100	100	100	95-100	50-65	20-30
	19-37	Silty clay, silty clay loam.	CH	A-7	0	100	100	100	95-100	50-65	25-35
	37-60	Silty clay loam, silt loam.	CL	A-7	0	100	100	100	95-100	40-50	15-25
792C2, 792D2----- Armstrong	0-8	Silt loam--------	CL, CL-ML	A-6, A-4	0-5	90-100	80-95	75-90	55-80	20-30	5-15
	8-45	Clay loam, clay, silty clay loam.	CL, CH	A-7	0-5	90-100	80-95	70-90	55-80	45-60	20-30
	45-60	Clay loam--------	CL	A-6	0-5	90-100	80-95	70-90	55-80	30-40	15-20
793B------------- Bertrand	0-8	Silt loam--------	CL-ML, CL	A-4, A-6	0	100	100	90-100	85-90	25-35	6-15
	8-42	Silt loam, silty clay loam.	CL	A-6, A-4	0	100	100	90-100	85-95	25-40	7-20
	42-60	Stratified silt loam to sand.	ML, SM, CL, SC	A-4	0	100	100	80-95	35-75	<30	4-10
795D2------------ Ashgrove	0-6	Silt loam--------	CL, CL-ML	A-6, A-4	0	100	95-100	90-100	85-100	20-30	5-15
	6-15	Silty clay, silty clay loam.	CH	A-7	0	100	95-100	85-100	85-100	55-70	30-40
	15-60	Clay, silty clay	CH	A-7	0	95-100	95-100	75-90	75-90	50-60	25-35
876B, 876C2------ Ladoga	0-8	Silt loam--------	CL, CL-ML	A-6, A-4	0	100	100	100	95-100	25-40	5-15
	8-39	Silty clay loam, silty clay.	CL, CH	A-7	0	100	100	100	95-100	40-55	25-35
	39-60	Silty clay loam, silt loam.	CL	A-6	0	100	100	100	95-100	30-40	15-20
880B, 880C2, 880D2------------ Clinton	0-8	Silt loam--------	ML	A-4	0	100	100	100	95-100	30-40	5-10
	8-37	Silty clay loam, silty clay.	CL, CH	A-7	0	100	100	100	95-100	40-55	25-35
	37-60	Silty clay loam, silt loam.	CL	A-6, A-7	0	100	100	100	95-100	35-45	15-25
881B------------- Otley	0-18	Silty clay loam	CL	A-7	0	100	100	100	95-100	40-50	15-25
	18-39	Silty clay loam, silty clay.	CL, CH	A-7	0	100	100	100	95-100	40-55	25-35
	39-60	Silty clay loam, silt loam.	CL	A-7, A-6	0	100	100	100	95-100	35-45	20-30
993D2*:											
Gara------------	0-12	Loam-------------	CL, CL-ML	A-4, A-6	0	95-100	85-95	75-85	55-70	20-30	5-15
	12-51	Clay loam, loam	CL	A-6	0-5	90-95	85-95	70-85	55-75	30-40	15-25
	51-60	Loam, clay loam	CL	A-6, A-7	0-5	90-95	85-95	70-85	55-75	35-45	15-25
Armstrong-------	0-8	Silt loam--------	CL, CL-ML	A-6, A-4	0-5	90-100	80-95	75-90	55-80	20-30	5-15
	8-45	Clay loam, clay, silty clay loam.	CL, CH	A-7	0-5	90-100	80-95	70-90	55-80	45-60	20-30
	45-60	Clay loam--------	CL	A-6	0-5	90-100	80-95	70-90	55-80	30-40	15-20
993D3*:											
Gara------------	0-7	Clay loam--------	CL	A-6, A-7	0	90-95	85-95	70-85	55-75	35-45	15-25
	7-40	Clay loam, loam	CL	A-6	0-5	90-95	85-95	70-85	55-75	30-40	15-25
	40-60	Loam, clay loam	CL	A-6, A-7	0-5	90-95	85-95	70-85	55-75	35-45	15-25
Armstrong-------	0-7	Clay loam--------	CL	A-6, A-7	0-5	90-100	80-95	75-90	55-80	35-45	15-25
	7-35	Clay loam, clay, silty clay loam.	CL, CH	A-7	0-5	90-100	80-95	70-90	55-80	45-60	20-30
	35-60	Clay loam--------	CL	A-6	0-5	90-100	80-95	70-90	55-80	30-40	15-20

See footnote at end of table.

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification Unified	Classification AASHTO	Fragments > 3 inches	Percentage passing sieve number-- 4	10	40	200	Liquid limit	Plasticity index
	In				Pct					Pct	
993E2*:											
Gara------------	0-12	Loam-------------	CL, CL-ML	A-4, A-6	0	95-100	85-95	75-85	55-70	20-30	5-15
	12-51	Clay loam, loam	CL	A-6	0-5	90-95	85-95	70-85	55-75	30-40	15-25
	51-60	Loam, clay loam	CL	A-6, A-7	0-5	90-95	85-95	70-85	55-75	35-45	15-25
Armstrong--------	0-8	Silt loam--------	CL, CL-ML	A-6, A-4	0-5	90-100	80-95	75-90	55-80	20-30	5-15
	8-45	Clay loam, clay, silty clay loam.	CL, CH	A-7	0-5	90-100	80-95	70-90	55-80	45-60	20-30
	45-60	Clay loam--------	CL	A-6	0-5	90-100	80-95	70-90	55-80	30-40	15-20
994D3*:											
Galland----------	0-6	Clay loam--------	CL	A-6	0	90-100	80-100	75-100	65-90	30-40	10-20
	6-31	Clay loam, clay, silty clay.	CL, CH	A-7	0-5	90-100	80-100	75-100	65-80	40-55	25-35
	31-60	Stratified sandy loam to clay.	SM-SC, SC, CL-ML, CL	A-4, A-2, A-6	0-5	90-100	80-100	65-95	30-60	20-35	5-15
Douds------------	0-10	Clay loam--------	CL	A-6	0	95-100	85-100	70-90	60-80	25-35	10-20
	10-46	Clay loam, loam, sandy clay loam.	CL, SC	A-6, A-7	0	90-100	85-100	70-80	35-60	30-45	15-25
	46-60	Stratified loamy sand to clay loam.	SC, CL, SM-SC, CL-ML	A-4, A-6, A-2	0	90-100	85-100	65-85	20-60	15-35	5-15
1075------------- Givin	0-13	Silt loam--------	CL, ML	A-4, A-6	0	100	100	100	95-100	30-40	5-15
	13-49	Silty clay loam, silty clay.	CL, CH	A-7	0	100	100	100	95-100	45-60	25-35
	49-60	Silty clay loam	CL	A-6, A-7	0	100	100	100	95-100	35-50	20-30
1180------------- Keomah	0-12	Silt loam--------	CL-ML, CL	A-4, A-6	0	100	100	100	95-100	25-35	5-15
	12-37	Silty clay loam, silty clay.	CH, CL	A-7	0	100	100	100	95-100	45-60	30-45
	37-60	Silty clay loam	CL	A-7, A-6	0	100	100	100	95-100	35-50	15-30
1280------------- Mahaska	0-17	Silty clay loam	CL	A-7, A-6	0	100	100	100	95-100	35-50	15-25
	17-42	Silty clay loam, silty clay.	CH, MH	A-7	0	100	100	100	95-100	50-60	20-30
	42-60	Silty clay loam, silt loam.	CL	A-7, A-6	0	100	100	100	95-100	35-45	15-20
1354*. Aquents											
1484------------- Lawson	0-34	Silt loam--------	CL, CL-ML	A-4	0	100	100	90-100	80-100	20-30	5-10
	34-60	Silty clay loam, silt loam.	CL	A-6	0	100	100	90-100	80-100	20-40	10-25
2226------------- Elrin	0-15	Loam-------------	CL, ML	A-4, A-6	0	100	100	85-95	50-70	30-40	5-15
	15-20	Loam-------------	CL, SC, CL-ML, SM-SC	A-4, A-6	0	100	100	80-90	40-55	25-35	5-15
	20-32	Sandy loam, fine sandy loam.	SM, SM-SC, SC	A-4	0	100	100	80-90	35-50	15-25	2-8
	32-60	Loamy sand, loamy fine sand, sand.	SM, SP-SM	A-2	0	100	100	70-85	10-30	---	NP
2242*:											
Nodaway----------	0-60	Silt loam--------	CL, CL-ML	A-4, A-6	0	100	95-100	95-100	90-100	25-35	5-15
Amana------------	0-16	Silt loam--------	CL	A-6	0	100	100	95-100	90-95	25-40	10-20
	16-48	Silt loam, silty clay loam.	CL	A-6, A-7	0	100	100	95-100	90-95	35-45	15-25
	48-60	Silt loam--------	CL	A-6	0	100	100	95-100	75-95	30-40	10-20

See footnote at end of table.

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag- ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
5030*. Pits											
5040*. Orthents											

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 16.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS

[The symbol < means less than; > means more than. Entries under "Erosion factors--T" apply to the entire profile. Entries under "Wind erodibility group" apply only to the surface layer. Absence of an entry indicates that data were not available or were not estimated]

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodibility group
	In	Pct	g/cc	In/hr	In/in	pH				
7B---------------- Wiota	0-19	24-32	1.30-1.35	0.6-2.0	0.21-0.23	5.1-7.3	Moderate-----	0.32	5	6
	19-51	30-36	1.30-1.40	0.6-2.0	0.18-0.20	5.1-6.5	Moderate-----	0.43		
	51-60	28-34	1.40-1.45	0.6-2.0	0.18-0.20	6.1-6.5	Moderate-----	0.43		
11B*:										
Colo-------------	0-20	27-32	1.28-1.32	0.6-2.0	0.21-0.23	5.6-7.3	High---------	0.28	5	7
	20-47	30-35	1.25-1.35	0.6-2.0	0.18-0.20	5.6-7.3	High---------	0.28		
	47-60	25-35	1.35-1.45	0.6-2.0	0.18-0.20	6.1-7.3	High---------	0.28		
Ely---------------	0-37	25-30	1.30-1.35	0.6-2.0	0.21-0.23	5.6-7.3	Moderate-----	0.32	5	7
	37-50	28-35	1.30-1.40	0.6-2.0	0.18-0.20	6.1-7.3	Moderate-----	0.43		
	50-60	20-30	1.40-1.45	0.6-2.0	0.18-0.20	6.6-8.4	Moderate-----	0.43		
24D2-------------- Shelby	0-10	24-27	1.50-1.55	0.6-2.0	0.20-0.22	5.1-7.3	Moderate-----	0.28	5	6
	10-51	30-35	1.55-1.75	0.2-0.6	0.16-0.18	5.1-7.3	Moderate-----	0.28		
	51-60	30-35	1.75-1.85	0.2-0.6	0.16-0.18	6.1-8.4	Moderate-----	0.37		
41C--------------- Sparta	0-23	3-10	1.20-1.40	2.0-6.0	0.09-0.12	5.1-7.3	Low----------	0.17	5	2
	23-38	1-8	1.40-1.60	6.0-20	0.05-0.11	5.1-6.5	Low----------	0.17		
	38-60	0-5	1.50-1.70	6.0-20	0.04-0.07	5.1-6.0	Low----------	0.17		
43---------------- Bremer	0-21	25-32	1.25-1.30	0.6-2.0	0.21-0.23	5.6-7.3	Moderate-----	0.28	5	7
	21-41	35-42	1.30-1.40	0.2-0.6	0.15-0.17	5.6-6.5	High---------	0.28		
	41-60	32-38	1.40-1.45	0.2-0.6	0.18-0.20	5.6-6.5	High---------	0.28		
54---------------- Zook	0-6	32-38	1.30-1.35	0.2-0.6	0.21-0.23	5.6-7.3	High---------	0.28	5	7
	6-60	36-45	1.30-1.45	0.06-0.2	0.11-0.13	5.6-7.8	High---------	0.28		
58D2, 58E2-------- Douds	0-10	20-27	1.45-1.50	0.6-2.0	0.15-0.17	5.1-7.3	Low----------	0.32	5	6
	10-38	26-35	1.45-1.65	0.6-2.0	0.15-0.17	4.5-6.0	Moderate-----	0.32		
	38-60	5-30	1.55-1.75	0.6-6.0	0.11-0.13	5.1-6.0	Low----------	0.32		
65D, 65D2, 65E, 65E2, 65F, 65F2, 65G-------------- Lindley	0-6	18-27	1.20-1.40	0.6-2.0	0.16-0.18	4.5-7.3	Low----------	0.32	5	6
	6-49	25-35	1.40-1.60	0.2-0.6	0.14-0.18	4.5-6.5	Moderate-----	0.32		
	49-60	18-32	1.45-1.65	0.2-0.6	0.12-0.16	6.1-7.8	Moderate-----	0.32		
74---------------- Rubio	0-8	16-24	1.35-1.40	0.6-2.0	0.22-0.24	5.1-7.3	Low----------	0.37	5	6
	8-16	16-22	1.40-1.45	0.6-2.0	0.20-0.22	5.1-6.0	Low----------	0.37		
	16-40	35-45	1.45-1.50	0.06-0.2	0.12-0.18	5.1-5.5	High---------	0.37		
	40-60	32-40	1.50-1.55	0.2-0.6	0.18-0.20	5.1-7.3	High---------	0.37		
75---------------- Givin	0-13	18-26	1.30-1.40	0.6-2.0	0.22-0.24	5.6-6.0	Moderate-----	0.32	5	6
	13-49	36-42	1.30-1.45	0.2-0.6	0.18-0.20	5.1-5.5	Moderate-----	0.43		
	49-60	27-34	1.40-1.50	0.2-0.6	0.18-0.20	5.1-6.0	Moderate-----	0.43		
76B, 76B2, 76C, 76C2------------ Ladoga	0-8	18-35	1.30-1.35	0.6-2.0	0.22-0.24	6.1-7.3	Low----------	0.32	5	6
	8-39	34-42	1.30-1.40	0.2-0.6	0.18-0.20	5.1-6.0	Moderate-----	0.43		
	39-60	24-32	1.35-1.45	0.6-2.0	0.18-0.20	5.1-6.5	Moderate-----	0.43		
76C3-------------- Ladoga	0-7	27-35	1.30-1.35	0.6-2.0	0.22-0.24	6.1-7.3	Low----------	0.32	5	6
	7-37	34-42	1.30-1.40	0.2-0.6	0.18-0.20	5.1-6.0	Moderate-----	0.43		
	37-60	24-32	1.35-1.45	0.6-2.0	0.18-0.20	5.1-6.5	Moderate-----	0.43		
76D2-------------- Ladoga	0-8	18-35	1.30-1.35	0.6-2.0	0.22-0.24	6.1-7.3	Low----------	0.32	5	6
	8-39	34-42	1.30-1.40	0.2-0.6	0.18-0.20	5.1-6.0	Moderate-----	0.43		
	39-60	24-32	1.35-1.45	0.6-2.0	0.18-0.20	5.1-6.5	Moderate-----	0.43		

See footnote at end of table.

TABLE 16.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodibility group
	In	Pct	g/cc	In/hr	In/in	pH				
76D3-------------	0-7	27-35	1.30-1.35	0.6-2.0	0.22-0.24	6.1-7.3	Low----------	0.32	5	6
Ladoga	7-37	34-42	1.30-1.40	0.2-0.6	0.18-0.20	5.1-6.0	Moderate-----	0.43		
	37-60	24-32	1.35-1.45	0.6-2.0	0.18-0.20	5.1-6.5	Moderate-----	0.43		
80B, 80C, 80C2---	0-8	16-26	1.30-1.40	0.6-2.0	0.20-0.22	5.1-7.3	Low----------	0.37	5	6
Clinton	8-37	32-42	1.35-1.45	0.2-0.6	0.16-0.20	4.5-6.0	Moderate-----	0.37		
	37-60	24-35	1.40-1.55	0.6-2.0	0.18-0.20	5.6-6.5	Moderate-----	0.37		
80C3-------------	0-7	27-34	1.30-1.40	0.6-2.0	0.18-0.20	5.1-7.3	Moderate-----	0.37	4	7
Clinton	7-43	32-42	1.35-1.45	0.2-0.6	0.16-0.20	4.5-6.0	Moderate-----	0.37		
	43-60	24-35	1.40-1.55	0.6-2.0	0.18-0.20	5.6-6.5	Moderate-----	0.37		
80D, 80D2--------	0-8	16-26	1.30-1.40	0.6-2.0	0.20-0.22	5.1-7.3	Low----------	0.37	5	6
Clinton	8-37	32-42	1.35-1.45	0.2-0.6	0.16-0.20	4.5-6.0	Moderate-----	0.37		
	37-60	24-35	1.40-1.55	0.6-2.0	0.18-0.20	5.6-6.5	Moderate-----	0.37		
80D3-------------	0-7	27-34	1.30-1.40	0.6-2.0	0.18-0.20	5.1-7.3	Moderate-----	0.37	4	7
Clinton	7-43	32-42	1.35-1.45	0.2-0.6	0.16-0.20	4.5-6.0	Moderate-----	0.37		
	43-60	24-35	1.40-1.55	0.6-2.0	0.18-0.20	5.6-6.5	Moderate-----	0.37		
87B*:										
Colo------------	0-20	27-32	1.28-1.32	0.6-2.0	0.21-0.23	5.6-7.3	High---------	0.28	5	7
	20-47	30-35	1.25-1.35	0.6-2.0	0.18-0.20	5.6-7.3	High---------	0.28		
	47-60	25-35	1.35-1.45	0.6-2.0	0.18-0.20	6.1-7.3	High---------	0.28		
Zook------------	0-6	32-38	1.30-1.35	0.2-0.6	0.21-0.23	5.6-7.3	High---------	0.28	5	7
	6-60	36-45	1.30-1.45	0.06-0.2	0.11-0.13	5.6-7.8	High---------	0.28		
88---------------	0-20	26-29	1.30-1.35	0.6-2.0	0.21-0.23	5.6-7.3	Moderate-----	0.32	5	7
Nevin	20-50	30-35	1.30-1.40	0.6-2.0	0.18-0.20	5.6-6.5	Moderate-----	0.43		
	50-60	25-36	1.40-1.45	0.6-2.0	0.18-0.20	5.6-7.3	Moderate-----	0.43		
93D2*:										
Shelby----------	0-10	24-27	1.50-1.55	0.6-2.0	0.20-0.22	5.1-7.3	Moderate-----	0.28	5	6
	10-51	30-35	1.55-1.75	0.2-0.6	0.16-0.18	5.1-7.3	Moderate-----	0.28		
	51-60	30-35	1.75-1.85	0.2-0.6	0.16-0.18	6.1-8.4	Moderate-----	0.37		
Adair-----------	0-10	27-35	1.45-1.50	0.2-0.6	0.17-0.19	5.6-7.3	Moderate-----	0.32	2	6
	10-35	38-50	1.50-1.60	0.06-0.2	0.13-0.16	5.1-6.5	High---------	0.32		
	35-60	30-38	1.60-1.85	0.2-0.6	0.14-0.16	5.6-7.8	Moderate-----	0.32		
93D3*:										
Shelby----------	0-7	27-35	1.50-1.55	0.2-0.6	0.16-0.18	5.1-7.3	Moderate-----	0.28	4	6
	7-42	30-35	1.55-1.75	0.2-0.6	0.16-0.18	5.1-7.3	Moderate-----	0.28		
	42-60	30-35	1.75-1.85	0.2-0.6	0.16-0.18	6.1-8.4	Moderate-----	0.37		
Adair-----------	0-7	27-38	1.45-1.50	0.2-0.6	0.17-0.19	5.6-7.3	Moderate-----	0.32	2	6
	7-42	38-50	1.50-1.60	0.06-0.2	0.13-0.16	5.1-6.5	High---------	0.32		
	42-60	30-38	1.60-1.85	0.2-0.6	0.14-0.16	5.6-7.8	Moderate-----	0.32		
122--------------	0-13	18-32	1.35-1.40	0.6-2.0	0.22-0.24	5.6-7.3	Moderate-----	0.28	5	6
Sperry	13-44	32-45	1.40-1.45	0.06-0.2	0.14-0.16	5.1-6.5	High---------	0.43		
	44-60	26-34	1.45-1.50	0.2-0.6	0.19-0.21	5.6-6.5	High---------	0.43		
133--------------	0-20	27-32	1.28-1.32	0.6-2.0	0.21-0.23	5.6-7.3	High---------	0.28	5	7
Colo	20-47	30-35	1.25-1.35	0.6-2.0	0.18-0.20	5.6-7.3	High---------	0.28		
	47-60	25-35	1.35-1.45	0.6-2.0	0.18-0.20	6.1-7.3	High---------	0.28		
133+-------------	0-12	20-26	1.25-1.30	0.6-2.0	0.22-0.24	5.6-7.3	Moderate-----	0.28	5	6
Colo	12-52	30-35	1.25-1.35	0.6-2.0	0.18-0.20	5.6-7.3	High---------	0.28		
	52-60	25-35	1.35-1.45	0.6-2.0	0.18-0.20	6.1-7.3	High---------	0.28		

See footnote at end of table.

TABLE 16.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodibility group
	In	Pct	g/cc	In/hr	In/in	pH				
163E, 163E2------ Fayette	0-15	15-25	1.30-1.35	0.6-2.0	0.20-0.22	5.1-7.3	Low----------	0.37	5	6
	15-51	25-35	1.30-1.45	0.6-2.0	0.18-0.20	4.5-6.0	Moderate-----	0.37		
	51-60	22-26	1.45-1.50	0.6-2.0	0.18-0.20	5.1-7.8	Moderate-----	0.37		
163E3------------ Fayette	0-7	25-32	1.35-1.45	0.6-2.0	0.18-0.20	5.1-7.3	Moderate-----	0.37	4	7
	7-37	25-35	1.30-1.45	0.6-2.0	0.18-0.20	4.5-6.0	Moderate-----	0.37		
	37-60	22-26	1.45-1.50	0.6-2.0	0.18-0.20	5.1-7.8	Moderate-----	0.37		
163F, 163G------- Fayette	0-15	15-25	1.30-1.35	0.6-2.0	0.20-0.22	5.1-7.3	Low----------	0.37	5	6
	15-51	25-35	1.30-1.45	0.6-2.0	0.18-0.20	4.5-6.0	Moderate-----	0.37		
	51-60	22-26	1.45-1.50	0.6-2.0	0.18-0.20	5.1-7.8	Moderate-----	0.37		
175-------------- Dickinson	0-8	10-18	1.50-1.55	2.0-6.0	0.12-0.15	5.6-7.3	Low----------	0.20	4	3
	8-38	10-15	1.45-1.55	2.0-6.0	0.12-0.15	5.1-6.5	Low----------	0.20		
	38-60	4-10	1.55-1.65	6.0-20	0.08-0.10	5.1-6.5	Low----------	0.20		
179D2, 179E2----- Gara	0-12	24-27	1.50-1.55	0.6-2.0	0.20-0.22	5.6-7.3	Moderate-----	0.28	5	6
	12-51	25-38	1.55-1.75	0.2-0.6	0.16-0.18	4.5-6.5	Moderate-----	0.28		
	51-60	24-38	1.75-1.85	0.2-0.6	0.16-0.18	6.6-8.4	Moderate-----	0.37		
180-------------- Keomah	0-12	16-22	1.30-1.40	0.6-2.0	0.22-0.24	4.5-7.3	Low----------	0.37	5	6
	12-37	27-42	1.30-1.45	0.06-0.6	0.18-0.20	4.5-5.5	High---------	0.37		
	37-60	27-38	1.40-1.55	0.2-0.6	0.18-0.20	5.1-6.5	Moderate-----	0.37		
192C2, 192D2----- Adair	0-10	27-35	1.45-1.50	0.2-0.6	0.17-0.19	5.6-7.3	Moderate-----	0.32	2	6
	10-35	38-50	1.50-1.60	0.06-0.2	0.13-0.16	5.1-6.5	High---------	0.32		
	35-60	30-38	1.60-1.85	0.2-0.6	0.14-0.16	5.6-7.8	Moderate-----	0.32		
219-------------- Jackson	0-12	15-22	1.35-1.60	0.6-2.0	0.22-0.24	5.6-7.3	Low----------	0.37	5	5
	12-19	15-27	1.35-1.60	0.6-2.0	0.20-0.22	5.6-7.3	Low----------	0.37		
	19-40	18-30	1.55-1.65	0.6-2.0	0.18-0.22	5.6-7.3	Moderate-----	0.37		
	40-60	10-20	1.55-1.65	0.6-2.0	0.09-0.22	5.1-6.5	Low----------	0.37		
220-------------- Nodaway	0-60	18-28	1.25-1.35	0.6-2.0	0.20-0.23	6.1-7.3	Moderate-----	0.37	5	6
222C2------------ Clarinda	0-11	30-38	1.45-1.50	0.2-0.6	0.17-0.19	5.1-7.3	Moderate-----	0.37	3	7
	11-39	40-60	1.45-1.60	<0.06	0.14-0.16	5.1-6.5	High---------	0.37		
	39-60	40-60	1.55-1.75	<0.06	0.14-0.16	5.6-7.3	High---------	0.37		
222C3------------ Clarinda	0-8	30-40	1.45-1.50	0.2-0.6	0.17-0.19	5.1-7.3	Moderate-----	0.37	3	7
	8-35	40-60	1.45-1.60	<0.06	0.14-0.16	5.1-6.5	High---------	0.37		
	35-60	40-60	1.55-1.75	<0.06	0.14-0.16	5.6-7.3	High---------	0.37		
222D2------------ Clarinda	0-11	30-38	1.45-1.50	0.2-0.6	0.17-0.19	5.1-7.3	Moderate-----	0.37	3	7
	11-39	40-60	1.45-1.60	<0.06	0.14-0.16	5.1-6.5	High---------	0.37		
	39-60	40-60	1.55-1.75	<0.06	0.14-0.16	5.6-7.3	High---------	0.37		
222D3------------ Clarinda	0-8	30-40	1.45-1.50	0.2-0.6	0.17-0.19	5.1-7.3	Moderate-----	0.37	3	7
	8-36	40-60	1.45-1.60	<0.06	0.14-0.16	5.1-6.5	High---------	0.37		
	36-60	40-60	1.55-1.75	<0.06	0.14-0.16	5.6-7.3	High---------	0.37		
223C2, 223D2----- Rinda	0-9	27-35	1.45-1.50	0.2-0.6	0.20-0.22	5.6-7.3	Moderate-----	0.43	2	6
	9-60	40-60	1.45-1.75	<0.06	0.14-0.16	5.1-7.3	High---------	0.32		
263-------------- Okaw	0-16	15-27	1.20-1.40	0.2-0.6	0.22-0.24	4.5-7.3	Low----------	0.43	3	6
	16-37	40-60	1.35-1.60	<0.06	0.09-0.18	4.5-6.0	High---------	0.32		
	37-45	35-60	1.45-1.70	<0.06	0.08-0.18	4.5-7.3	High---------	0.32		
	45-60	35-55	1.50-1.70	<0.06	0.08-0.20	3.6-7.3	High---------	0.32		
264B------------- Ainsworth	0-9	18-26	1.30-1.40	0.6-2.0	0.20-0.22	6.1-7.3	Low----------	0.37	5	6
	9-43	32-40	1.35-1.45	0.2-0.6	0.16-0.20	4.5-6.5	Moderate-----	0.37		
	43-60	4-12	1.55-1.65	6.0-20	0.05-0.07	4.5-7.3	Low----------	0.37		

See footnote at end of table.

TABLE 16.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodi-bility group
	In	Pct	g/cc	In/hr	In/in	pH				
269-------------- Humeston	0-12	24-30	1.35-1.40	0.2-2.0	0.21-0.23	5.1-7.3	Moderate-----	0.32	4	6
	12-20	20-26	1.30-1.35	0.2-2.0	0.20-0.22	4.5-6.0	Moderate-----	0.32		
	20-60	30-48	1.35-1.50	<0.06	0.13-0.15	4.5-6.5	High---------	0.32		
279-------------- Taintor	0-17	30-36	1.30-1.40	0.2-0.6	0.21-0.23	5.6-7.3	Moderate-----	0.28	5	7
	17-40	35-44	1.30-1.45	0.2-0.6	0.14-0.18	5.6-6.5	High---------	0.43		
	40-60	24-34	1.40-1.50	0.6-2.0	0.18-0.20	6.1-7.8	Moderate-----	0.43		
280-------------- Mahaska	0-17	20-37	1.30-1.40	0.6-2.0	0.21-0.23	5.1-7.3	Moderate-----	0.32	5	6
	17-42	34-42	1.30-1.45	0.6-2.0	0.14-0.18	4.5-6.0	Moderate-----	0.43		
	42-60	24-32	1.40-1.45	0.6-2.0	0.18-0.20	5.6-7.3	Moderate-----	0.43		
281B, 281B2, 281C, 281C2----- Otley	0-18	28-38	1.25-1.35	0.6-2.0	0.21-0.23	5.1-7.3	Moderate-----	0.32	5	7
	18-39	36-42	1.30-1.40	0.6-2.0	0.18-0.20	5.1-6.0	Moderate-----	0.43		
	39-60	24-35	1.35-1.45	0.6-2.0	0.18-0.20	5.6-7.3	Moderate-----	0.43		
281C3------------ Otley	0-8	28-38	1.25-1.35	0.6-2.0	0.21-0.23	5.1-7.3	Moderate-----	0.32	5	7
	8-39	36-42	1.30-1.40	0.6-2.0	0.18-0.20	5.1-6.0	Moderate-----	0.43		
	39-60	24-35	1.35-1.45	0.6-2.0	0.18-0.20	5.6-7.3	Moderate-----	0.43		
281D2------------ Otley	0-18	28-34	1.25-1.35	0.6-2.0	0.21-0.23	5.1-7.3	Moderate-----	0.32	5	7
	18-39	36-42	1.30-1.40	0.6-2.0	0.18-0.20	5.1-6.0	Moderate-----	0.43		
	39-60	24-35	1.35-1.45	0.6-2.0	0.18-0.20	5.6-7.3	Moderate-----	0.43		
281D3------------ Otley	0-8	28-38	1.25-1.35	0.6-2.0	0.21-0.23	5.1-7.3	Moderate-----	0.32	5	7
	8-39	36-42	1.30-1.40	0.6-2.0	0.18-0.20	5.1-6.0	Moderate-----	0.43		
	39-60	24-35	1.35-1.45	0.6-2.0	0.18-0.20	5.6-7.3	Moderate-----	0.43		
293E2*:										
Fayette---------	0-15	15-25	1.30-1.35	0.6-2.0	0.20-0.22	5.1-7.3	Low----------	0.37	5	6
	15-51	25-35	1.30-1.45	0.6-2.0	0.18-0.20	4.5-6.0	Moderate-----	0.37		
	51-60	22-26	1.45-1.50	0.6-2.0	0.18-0.20	5.1-7.8	Moderate-----	0.37		
Lamont----------	0-10	10-15	1.50-1.55	2.0-6.0	0.16-0.18	5.1-7.3	Low----------	0.24	5	3
	10-30	10-22	1.45-1.65	2.0-6.0	0.14-0.16	5.1-6.0	Low----------	0.24		
	30-60	2-10	1.65-1.75	6.0-20	0.09-0.11	5.1-6.5	Low----------	0.17		
Chelsea---------	0-7	8-15	1.50-1.55	6.0-20	0.10-0.15	5.6-7.3	Low----------	0.17	5	2
	7-60	5-10	1.55-1.70	6.0-20	0.06-0.08	5.1-5.5	Low----------	0.17		
294C2*, 294D2*:										
Ladoga----------	0-8	18-35	1.30-1.35	0.6-2.0	0.22-0.24	6.1-7.3	Low----------	0.32	5	6
	8-39	34-42	1.30-1.40	0.2-0.6	0.18-0.20	5.1-6.0	Moderate-----	0.43		
	39-60	24-32	1.35-1.45	0.6-2.0	0.18-0.20	5.1-6.5	Moderate-----	0.43		
Billett---------	0-8	7-15	1.40-1.70	2.0-6.0	0.13-0.18	5.6-7.3	Low----------	0.20	5	3
	8-40	10-18	1.40-1.70	2.0-6.0	0.10-0.15	5.1-6.5	Low----------	0.20		
	40-60	2-18	1.50-1.80	2.0-20	0.02-0.12	5.6-7.3	Low----------	0.20		
295C2*, 295D2*:										
Clinton---------	0-8	16-26	1.30-1.40	0.6-2.0	0.20-0.22	5.1-7.3	Low----------	0.37	5	6
	8-37	32-42	1.35-1.45	0.2-0.6	0.16-0.20	4.5-6.0	Moderate-----	0.37		
	37-60	24-35	1.40-1.55	0.6-2.0	0.18-0.20	5.6-6.5	Moderate-----	0.37		
Lamont----------	0-10	10-15	1.50-1.55	2.0-6.0	0.16-0.18	5.1-7.3	Low----------	0.24	5	3
	10-30	10-22	1.45-1.65	2.0-6.0	0.14-0.16	5.1-6.0	Low----------	0.24		
	30-60	2-10	1.65-1.75	6.0-20	0.09-0.11	5.1-6.5	Low----------	0.17		
Chelsea---------	0-7	8-15	1.50-1.55	6.0-20	0.10-0.15	5.6-7.3	Low----------	0.17	5	2
	7-60	5-10	1.55-1.70	6.0-20	0.06-0.08	5.1-5.5	Low----------	0.17		

See footnote at end of table.

TABLE 16.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodi-bility group
	In	Pct	g/cc	In/hr	In/in	pH				
295D3*:										
Clinton----------	0-7	27-34	1.30-1.40	0.6-2.0	0.18-0.20	5.1-7.3	Moderate-----	0.37	4	7
	7-43	32-42	1.35-1.45	0.2-0.6	0.16-0.20	4.5-6.0	Moderate-----	0.37		
	43-60	24-35	1.40-1.55	0.6-2.0	0.18-0.20	5.6-6.5	Moderate-----	0.37		
Lamont-----------	0-7	10-15	1.50-1.55	2.0-6.0	0.16-0.18	5.1-7.3	Low----------	0.24	5	3
	7-24	10-22	1.45-1.65	2.0-6.0	0.14-0.16	5.1-6.0	Low----------	0.24		
	24-60	2-10	1.65-1.75	6.0-20	0.09-0.11	5.1-6.5	Low----------	0.17		
Chelsea----------	0-7	8-15	1.50-1.55	6.0-20	0.10-0.15	5.6-7.3	Low----------	0.17	5	2
	7-60	5-10	1.55-1.70	6.0-20	0.06-0.08	5.1-5.5	Low----------	0.17		
422-------------- Amana	0-16	18-30	1.20-1.30	0.6-2.0	0.22-0.24	5.6-7.3	Moderate-----	0.37	5	6
	16-48	18-30	1.25-1.40	0.6-2.0	0.20-0.22	5.1-6.5	Moderate-----	0.37		
	48-60	18-26	1.25-1.40	0.6-2.0	0.20-0.22	5.6-6.5	Moderate-----	0.37		
424D*, 424D2*:										
Lindley----------	0-6	18-27	1.20-1.40	0.6-2.0	0.16-0.18	4.5-7.3	Low----------	0.32	5	6
	6-49	25-35	1.40-1.60	0.2-0.6	0.14-0.18	4.5-6.5	Moderate-----	0.32		
	49-60	18-32	1.45-1.65	0.2-0.6	0.12-0.16	6.1-7.8	Moderate-----	0.32		
Keswick----------	0-8	22-30	1.45-1.50	0.6-2.0	0.17-0.22	4.5-7.3	Moderate-----	0.37	3	6
	8-28	35-48	1.45-1.60	0.06-0.2	0.11-0.15	4.5-6.0	High---------	0.37		
	28-60	30-40	1.60-1.80	0.2-0.6	0.12-0.16	4.5-6.0	Moderate-----	0.37		
424D3*:										
Lindley----------	0-4	27-35	1.30-1.40	0.2-0.6	0.14-0.18	4.5-7.3	Moderate-----	0.32	4	6
	4-40	25-35	1.40-1.60	0.2-0.6	0.14-0.18	4.5-6.5	Moderate-----	0.32		
	40-60	18-32	1.45-1.65	0.2-0.6	0.12-0.16	6.1-7.8	Moderate-----	0.32		
Keswick----------	0-4	27-38	1.45-1.50	0.2-0.6	0.17-0.19	4.5-7.3	Moderate-----	0.37	2	6
	4-18	35-48	1.45-1.60	0.06-0.2	0.11-0.15	4.5-6.0	High---------	0.37		
	18-60	30-40	1.60-1.80	0.2-0.6	0.12-0.16	4.5-6.0	Moderate-----	0.37		
424E2*:										
Lindley----------	0-6	18-27	1.20-1.40	0.6-2.0	0.16-0.18	4.5-7.3	Low----------	0.32	5	6
	6-49	25-35	1.40-1.60	0.2-0.6	0.14-0.18	4.5-6.5	Moderate-----	0.32		
	49-60	18-32	1.45-1.65	0.2-0.6	0.12-0.16	6.1-7.8	Moderate-----	0.32		
Keswick----------	0-8	22-30	1.45-1.50	0.6-2.0	0.17-0.22	4.5-7.3	Moderate-----	0.37	3	6
	8-28	35-48	1.45-1.60	0.06-0.2	0.11-0.15	4.5-6.0	High---------	0.37		
	28-60	30-40	1.60-1.80	0.2-0.6	0.12-0.16	4.5-6.0	Moderate-----	0.37		
425D2------------ Keswick	0-8	22-30	1.45-1.50	0.6-2.0	0.17-0.22	4.5-7.3	Moderate-----	0.37	3	6
	8-28	35-48	1.45-1.60	0.06-0.2	0.11-0.15	4.5-6.0	High---------	0.37		
	28-60	30-40	1.60-1.80	0.2-0.6	0.12-0.16	4.5-6.0	Moderate-----	0.37		
428B------------- Ely	0-37	25-30	1.30-1.35	0.6-2.0	0.21-0.23	5.6-7.3	Moderate-----	0.32	5	7
	37-50	28-35	1.30-1.40	0.6-2.0	0.18-0.20	6.1-7.3	Moderate-----	0.43		
	50-60	20-30	1.40-1.45	0.6-2.0	0.18-0.20	6.6-8.4	Moderate-----	0.43		
430-------------- Ackmore	0-26	25-30	1.25-1.30	0.6-2.0	0.21-0.23	5.6-7.3	Moderate-----	0.37	5	6
	26-60	26-38	1.30-1.40	0.6-2.0	0.18-0.20	5.6-7.8	High---------	0.37		
453-------------- Tuskeego	0-9	16-22	1.35-1.40	0.6-2.0	0.19-0.23	5.1-7.3	Moderate-----	0.32	3	5
	9-30	32-48	1.30-1.45	<0.06	0.13-0.17	5.1-6.5	High---------	0.32		
	30-60	28-40	1.40-1.50	0.06-0.2	0.16-0.19	5.6-6.5	Moderate-----	0.32		
484-------------- Lawson	0-34	10-20	1.20-1.55	0.6-2.0	0.22-0.24	6.1-7.8	Low----------	0.28	5	5
	34-60	18-30	1.55-1.65	0.6-2.0	0.18-0.20	6.1-7.8	Moderate-----	0.43		

See footnote at end of table.

TABLE 16.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodi-bility group
	In	Pct	g/cc	In/hr	In/in	pH				
499F-------------- Nordness	0-8	18-24	1.30-1.35	0.6-2.0	0.20-0.22	5.6-7.3	Low----------	0.43	2	6
	8-13	22-29	1.35-1.45	0.6-2.0	0.20-0.22	5.6-7.3	Moderate-----	0.43		
	13-17	27-45	1.35-1.60	0.06-0.2	0.12-0.15	5.6-7.3	High---------	0.43		
	17	---	---	---	---	---	-------------	----		
520, 520B-------- Coppock	0-7	16-26	1.30-1.35	0.6-2.0	0.20-0.24	6.1-7.3	Moderate-----	0.32	5	6
	7-26	16-27	1.30-1.40	0.6-2.0	0.18-0.22	5.6-7.3	Moderate-----	0.43		
	26-50	24-35	1.30-1.40	0.6-2.0	0.17-0.21	4.5-6.0	Moderate-----	0.43		
	50-60	24-40	1.40-1.45	0.6-2.0	0.15-0.19	4.5-6.0	Moderate-----	0.43		
539-------------- Perks	0-8	10-15	1.50-1.55	2.0-6.0	0.12-0.15	5.6-6.5	Low----------	0.20	5	3
	8-60	2-10	1.50-1.75	6.0-20	0.02-0.04	5.6-6.5	Low----------	0.15		
570B, 570B2, 570C2----------- Nira	0-12	28-34	1.25-1.40	0.6-2.0	0.21-0.23	5.6-7.3	Moderate-----	0.32	5	7
	12-43	30-38	1.25-1.40	0.6-2.0	0.18-0.20	5.1-6.0	Moderate-----	0.43		
	43-60	24-34	1.35-1.45	0.6-2.0	0.18-0.20	5.6-6.5	Moderate-----	0.43		
570C3------------ Nira	0-8	28-36	1.25-1.40	0.6-2.0	0.21-0.23	5.6-7.3	Moderate-----	0.32	5	7
	8-33	30-38	1.25-1.40	0.6-2.0	0.18-0.20	5.1-6.0	Moderate-----	0.43		
	33-60	24-34	1.35-1.45	0.6-2.0	0.18-0.20	5.6-6.5	Moderate-----	0.43		
571B, 571B2, 571C2----------- Hedrick	0-8	16-27	1.30-1.35	0.6-2.0	0.21-0.23	5.6-7.3	Low----------	0.32	5	6
	8-38	27-37	1.30-1.45	0.6-2.0	0.18-0.20	5.1-6.5	Moderate-----	0.43		
	38-60	24-32	1.40-1.45	0.6-2.0	0.18-0.20	5.6-7.8	Moderate-----	0.43		
571C3------------ Hedrick	0-7	27-34	1.30-1.35	0.6-2.0	0.20-0.22	5.6-7.3	Moderate-----	0.32	4	7
	7-30	27-37	1.30-1.45	0.6-2.0	0.18-0.20	5.1-6.5	Moderate-----	0.43		
	30-60	24-32	1.40-1.45	0.6-2.0	0.18-0.20	5.6-7.8	Moderate-----	0.43		
572B, 572C2------ Inton	0-5	22-27	1.30-1.40	0.6-2.0	0.20-0.22	5.1-7.3	Low----------	0.37	5	6
	5-49	27-37	1.35-1.45	0.6-2.0	0.18-0.20	5.1-6.5	Moderate-----	0.37		
	49-60	25-32	1.30-1.40	0.6-2.0	0.18-0.20	5.1-7.3	Moderate-----	0.37		
592D2------------ Mystic	0-7	22-32	1.40-1.45	0.6-2.0	0.22-0.24	4.5-6.5	Moderate-----	0.37	3	6
	7-33	30-48	1.45-1.65	0.06-0.2	0.15-0.19	4.5-6.5	High---------	0.37		
	33-56	20-35	1.65-1.75	0.6-2.0	0.16-0.18	4.5-6.5	Moderate-----	0.37		
	56-60	10-30	1.65-1.75	0.6-6.0	0.11-0.13	5.1-6.5	Low----------	0.24		
687B------------- Watkins	0-14	18-24	1.30-1.35	0.6-2.0	0.20-0.24	5.6-7.3	Moderate-----	0.32	5	6
	14-49	25-35	1.35-1.40	0.6-2.0	0.15-0.19	5.1-6.5	Moderate-----	0.43		
	49-60	25-32	1.40-1.45	0.6-2.0	0.14-0.18	5.6-6.5	Moderate-----	0.43		
688-------------- Koszta	0-14	18-24	1.30-1.40	0.6-2.0	0.20-0.24	5.1-7.3	Moderate-----	0.32	5	6
	14-60	28-35	1.30-1.45	0.6-2.0	0.15-0.19	5.1-7.3	Moderate-----	0.43		
715*:										
Nodaway---------	0-60	18-28	1.25-1.35	0.6-2.0	0.20-0.23	6.1-7.3	Moderate-----	0.37	5	6
Perks-----------	0-8	10-15	1.50-1.55	2.0-6.0	0.12-0.15	5.6-6.5	Low----------	0.20	5	3
	8-60	2-10	1.50-1.75	6.0-20	0.02-0.04	5.6-6.5	Low----------	0.15		
729B*:										
Ackmore---------	0-26	25-30	1.25-1.30	0.6-2.0	0.21-0.23	5.6-7.3	Moderate-----	0.37	5	6
	26-60	26-38	1.30-1.40	0.6-2.0	0.18-0.20	5.6-7.8	High---------	0.37		
Nodaway---------	0-60	18-28	1.25-1.35	0.6-2.0	0.20-0.23	6.1-7.3	Moderate-----	0.37	5	6
779-------------- Kalona	0-19	36-39	1.35-1.40	0.2-0.6	0.18-0.20	5.6-7.3	High---------	0.28	5	7
	19-37	36-42	1.40-1.45	0.2-0.6	0.14-0.18	5.6-7.3	High---------	0.37		
	37-60	26-34	1.45-1.50	0.2-0.6	0.18-0.20	6.1-7.8	Moderate-----	0.37		

See footnote at end of table.

TABLE 16.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodi-bility group
	In	Pct	g/cc	In/hr	In/in	pH				
792C2, 792D2----- Armstrong	0-8	22-27	1.45-1.50	0.6-2.0	0.20-0.22	5.6-7.3	Moderate-----	0.32	3	6
	8-45	36-48	1.45-1.55	0.06-0.2	0.11-0.16	4.5-6.5	High---------	0.32		
	45-60	30-36	1.55-1.75	0.2-0.6	0.14-0.16	5.1-7.3	Moderate-----	0.32		
793B------------ Bertrand	0-8	15-22	1.35-1.60	0.6-2.0	0.22-0.24	5.6-7.3	Low----------	0.37	5	5
	8-42	18-30	1.55-1.65	0.6-2.0	0.18-0.22	5.1-6.5	Moderate-----	0.37		
	42-60	10-22	1.55-1.65	0.6-6.0	0.09-0.22	5.1-6.5	Low----------	0.37		
795D2----------- Ashgrove	0-6	22-27	1.45-1.50	0.2-0.6	0.20-0.22	4.5-7.3	Moderate-----	0.43	3	6
	6-15	35-45	1.45-1.50	<0.06	0.12-0.14	4.5-6.5	High---------	0.32		
	15-60	40-60	1.45-1.75	<0.06	0.12-0.14	4.5-7.3	High---------	0.32		
876B, 876C2------ Ladoga	0-8	18-35	1.30-1.35	0.6-2.0	0.22-0.24	6.1-7.3	Low----------	0.32	5	6
	8-39	36-42	1.30-1.40	0.2-0.6	0.18-0.20	5.1-6.0	Moderate-----	0.43		
	39-60	24-32	1.35-1.45	0.6-2.0	0.18-0.20	5.1-6.5	Moderate-----	0.43		
880B, 880C2, 880D2----------- Clinton	0-8	16-26	1.30-1.40	0.6-2.0	0.20-0.22	5.1-7.3	Low----------	0.37	5	6
	8-37	32-42	1.35-1.45	0.2-0.6	0.16-0.20	4.5-6.0	Moderate-----	0.37		
	37-60	24-35	1.40-1.55	0.6-2.0	0.18-0.20	5.6-6.5	Moderate-----	0.37		
881B------------ Otley	0-18	28-34	1.25-1.35	0.6-2.0	0.21-0.23	5.1-7.3	Moderate-----	0.32	5	7
	18-39	36-42	1.30-1.40	0.6-2.0	0.18-0.20	5.1-5.5	Moderate-----	0.43		
	39-60	24-35	1.35-1.45	0.6-2.0	0.18-0.20	5.6-7.3	Moderate-----	0.43		
993D2*:										
Gara-----------	0-12	24-27	1.50-1.55	0.6-2.0	0.20-0.22	5.6-7.3	Moderate-----	0.28	5	6
	12-51	25-38	1.55-1.75	0.2-0.6	0.16-0.18	4.5-6.5	Moderate-----	0.28		
	51-60	24-38	1.75-1.85	0.2-0.6	0.16-0.18	6.6-8.4	Moderate-----	0.37		
Armstrong-------	0-8	22-27	1.45-1.50	0.6-2.0	0.20-0.22	5.6-7.3	Moderate-----	0.32	3	6
	8-45	36-48	1.45-1.55	0.06-0.2	0.11-0.16	4.5-6.5	High---------	0.32		
	45-60	30-36	1.55-1.75	0.2-0.6	0.14-0.16	5.1-7.3	Moderate-----	0.32		
993D3*:										
Gara-----------	0-7	27-35	1.50-1.55	0.2-0.6	0.16-0.18	5.6-7.3	Moderate-----	0.28	4	6
	7-40	25-38	1.55-1.75	0.2-0.6	0.16-0.18	4.5-6.5	Moderate-----	0.28		
	40-60	24-38	1.75-1.85	0.2-0.6	0.16-0.18	6.6-8.4	Moderate-----	0.37		
Armstrong-------	0-7	27-38	1.45-1.50	0.2-0.6	0.18-0.20	5.6-7.3	Moderate-----	0.32	2	6
	7-35	36-48	1.45-1.55	0.06-0.2	0.11-0.16	4.5-6.5	High---------	0.32		
	35-60	30-36	1.55-1.75	0.2-0.6	0.14-0.16	5.1-7.3	Moderate-----	0.32		
993E2*:										
Gara-----------	0-12	24-27	1.50-1.55	0.6-2.0	0.20-0.22	5.6-7.3	Moderate-----	0.28	5	6
	12-51	25-38	1.55-1.75	0.2-0.6	0.16-0.18	4.5-6.5	Moderate-----	0.28		
	51-60	24-38	1.75-1.85	0.2-0.6	0.16-0.18	6.6-8.4	Moderate-----	0.37		
Armstrong-------	0-8	22-27	1.45-1.50	0.6-2.0	0.20-0.22	5.6-7.3	Moderate-----	0.32	3	6
	8-45	36-48	1.45-1.55	0.06-0.2	0.11-0.16	4.5-6.5	High---------	0.32		
	45-60	30-36	1.55-1.75	0.2-0.6	0.14-0.16	5.1-7.3	Moderate-----	0.32		
994D3*:										
Galland---------	0-6	22-35	1.45-1.50	0.6-2.0	0.19-0.21	5.6-7.3	Moderate-----	0.37	3	6
	6-31	35-48	1.45-1.75	0.06-0.2	0.14-0.19	5.1-6.0	High---------	0.37		
	31-60	10-45	1.55-1.75	0.6-6.0	0.11-0.13	5.1-6.5	Low----------	0.24		
Douds-----------	0-10	20-30	1.45-1.50	0.6-2.0	0.15-0.17	5.1-7.3	Low----------	0.32	5	6
	10-46	26-35	1.45-1.65	0.6-2.0	0.15-0.17	4.5-6.0	Moderate-----	0.32		
	46-60	5-30	1.55-1.75	0.6-6.0	0.11-0.13	5.1-6.0	Low----------	0.32		
1075------------ Givin	0-13	18-26	1.30-1.40	0.6-2.0	0.22-0.24	5.6-6.0	Moderate-----	0.32	5	6
	13-49	36-42	1.30-1.45	0.2-0.6	0.18-0.20	5.1-6.0	Moderate-----	0.43		
	49-60	27-34	1.40-1.50	0.2-0.6	0.18-0.20	5.1-6.0	Moderate-----	0.43		

See footnote at end of table.

TABLE 16.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodi-bility group
	In	Pct	g/cc	In/hr	In/in	pH				
1180------------ Keomah	0-12	16-22	1.30-1.40	0.6-2.0	0.22-0.24	4.5-7.3	Low----------	0.37	5	6
	12-37	27-42	1.30-1.45	0.06-0.6	0.18-0.20	4.5-5.5	High---------	0.37		
	37-60	27-38	1.40-1.55	0.2-0.6	0.18-0.20	5.1-6.5	Moderate-----	0.37		
1280------------ Mahaska	0-17	20-37	1.30-1.40	0.6-2.0	0.21-0.23	5.1-7.3	Moderate-----	0.32	5	6
	17-42	34-42	1.30-1.45	0.6-2.0	0.14-0.18	4.5-6.0	Moderate-----	0.43		
	42-60	24-32	1.40-1.45	0.6-2.0	0.18-0.20	5.6-7.3	Moderate-----	0.43		
1354*. Aquents										
1484------------ Lawson	0-34	10-20	1.20-1.55	0.6-2.0	0.22-0.24	6.1-7.8	Low----------	0.28	5	5
	34-60	18-30	1.55-1.65	0.6-2.0	0.18-0.20	6.1-7.8	Moderate-----	0.43		
2226------------ Elrin	0-15	16-25	1.40-1.45	0.6-2.0	0.20-0.22	5.1-7.3	Low----------	0.28	4	6
	15-20	14-22	1.45-1.50	0.6-2.0	0.17-0.19	5.1-6.5	Low----------	0.28		
	20-32	8-18	1.50-1.60	2.0-6.0	0.11-0.13	5.1-6.5	Low----------	0.28		
	32-60	4-10	1.60-1.70	6.0-20	0.08-0.10	5.1-6.5	Low----------	0.17		
2242*: Nodaway---------	0-60	18-28	1.25-1.35	0.6-2.0	0.20-0.23	6.1-7.3	Moderate-----	0.37	5	6
Amana-----------	0-16	18-30	1.20-1.30	0.6-2.0	0.22-0.24	5.6-7.3	Moderate-----	0.37	5	6
	16-48	18-30	1.25-1.40	0.6-2.0	0.20-0.22	5.1-6.5	Moderate-----	0.37		
	48-60	18-26	1.25-1.40	0.6-2.0	0.20-0.22	5.6-6.5	Moderate-----	0.37		
5030*. Pits										
5040*. Orthents										

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 17.--SOIL AND WATER FEATURES

["Flooding" and "water table" and terms such as "rare," "brief," "apparent," and "perched" are explained in the text. The symbol < means less than; > means more than. Absence of an entry indicates that the feature is not a concern or that data were not estimated]

Soil name and map symbol	Hydro-logic group	Flooding			High water table			Bedrock		Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hard-ness	Uncoated steel	Concrete
					Ft			In			
7B----------------- Wiota	B	Rare---------	---	---	>6.0	---	---	>60	---	Moderate	Moderate.
11B*:											
Colo---------------	B	None---------	---	---	1.0-3.0	Apparent	Nov-Jul	>60	---	High-----	Moderate.
Ely----------------	B	None---------	---	---	2.0-4.0	Apparent	Nov-Jul	>60	---	High-----	Moderate.
24D2--------------- Shelby	B	None---------	---	---	>6.0	---	---	>60	---	Moderate	Moderate.
41C---------------- Sparta	A	None---------	---	---	>6.0	---	---	>60	---	Low------	Moderate.
43----------------- Bremer	C	Rare---------	---	---	1.0-2.0	Apparent	Nov-Jul	>60	---	Moderate	Moderate.
54----------------- Zook	C/D	Occasional	Brief to long.	Feb-Nov	1.0-3.0	Apparent	Nov-Jul	>60	---	High-----	Moderate.
58D2, 58E2--------- Douds	B	None---------	---	---	4.0-6.0	Apparent	Nov-Jul	>60	---	Moderate	Moderate.
65D, 65D2, 65E, 65E2, 65F, 65F2, 65G--------------- Lindley	C	None---------	---	---	>6.0	---	---	>60	---	Moderate	Moderate.
74----------------- Rubio	C/D	None---------	---	---	0-1.0	Perched	Nov-Jul	>60	---	High-----	Moderate.
75----------------- Givin	C	None---------	---	---	2.0-4.0	Apparent	Nov-Jul	>60	---	High-----	Moderate.
76B, 76B2, 76C, 76C2, 76C3, 76D2, 76D3------------- Ladoga	B	None---------	---	---	>6.0	---	---	>60	---	Moderate	Moderate.
80B, 80C, 80C2, 80C3, 80D, 80D2, 80D3------------- Clinton	B	None---------	---	---	>6.0	---	---	>60	---	Moderate	Moderate.

See footnote at end of table.

TABLE 17.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydro-logic group	Flooding			High water table			Bedrock		Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hard-ness	Uncoated steel	Concrete
					Ft			In			
87B*:											
Colo	B	None	---	---	1.0-3.0	Apparent	Nov-Jul	>60	---	High	Moderate.
Zook	C/D	None	---	---	1.0-3.0	Apparent	Nov-Jul	>60	---	High	Moderate.
88 Nevin	B	Rare	---	---	2.0-4.0	Apparent	Nov-Jul	>60	---	High	Low.
93D2*, 93D3*:											
Shelby	B	None	---	---	>6.0	---	---	>60	---	Moderate	Moderate.
Adair	C	None	---	---	1.0-3.0	Perched	Nov-Jul	>60	---	High	Moderate.
122 Sperry	C/D	None	---	---	+1-1.0	Apparent	Nov-Jul	>60	---	High	Moderate.
133, 133+ Colo	B/D	Occasional	Very brief to long.	Feb-Nov	1.0-3.0	Apparent	Nov-Jul	>60	---	High	Moderate.
163E, 163E2, 163E3, 163F, 163G Fayette	B	None	---	---	>6.0	---	---	>60	---	Moderate	Moderate.
175 Dickinson	B	None	---	---	>6.0	---	---	>60	---	Low	Moderate.
179D2, 179E2 Gara	C	None	---	---	>6.0	---	---	>60	---	Moderate	Moderate.
180 Keomah	C	None	---	---	2.0-4.0	Apparent	Nov-Jul	>60	---	High	Moderate.
192C2, 192D2 Adair	C	None	---	---	1.0-3.0	Perched	Nov-Jul	>60	---	High	Moderate.
219 Jackson	B	Rare	---	---	2.5-6.0	Apparent	Nov-Jul	>60	---	Moderate	Moderate.
220 Nodaway	B	Occasional	Very brief to brief.	Feb-Nov	3.0-5.0	Apparent	Nov-Jul	>60	---	Moderate	Low.
222C2, 222C3, 222D2, 222D3 Clarinda	D	None	---	---	1.0-3.0	Perched	Nov-Jul	>60	---	High	Moderate.
223C2, 223D2 Rinda	D	None	---	---	1.0-3.0	Perched	Nov-Jul	>60	---	High	Moderate.

See footnote at end of table.

TABLE 17.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydro-logic group	Flooding: Frequency	Flooding: Duration	Flooding: Months	High water table: Depth	High water table: Kind	High water table: Months	Bedrock: Depth	Bedrock: Hard-ness	Risk of corrosion: Uncoated steel	Risk of corrosion: Concrete
					Ft			In			
263---------------- Okaw	D	Rare---------	---	---	+.5-1.0	Apparent	Nov-Jul	>60	---	High------	High.
264B--------------- Ainsworth	B	Rare---------	---	---	>6.0	---	---	>60	---	Moderate	Moderate.
269---------------- Humeston	C/D	Occasional	Very brief	Feb-Nov	0-1.0	Apparent	Nov-Jul	>60	---	High------	Moderate.
279---------------- Taintor	C/D	None---------	---	---	1.0-2.0	Apparent	Nov-Jul	>60	---	High------	Moderate.
280---------------- Mahaska	B	None---------	---	---	2.0-4.0	Apparent	Nov-Jul	>60	---	High------	Moderate.
281B, 281B2, 281C, 281C2, 281C3, 281D2, 281D3------ Otley	B	None---------	---	---	>6.0	---	---	>60	---	Moderate	Moderate.
293E2*:											
Fayette-----------	B	None---------	---	---	>6.0	---	---	>60	---	Moderate	Moderate.
Lamont------------	B	None---------	---	---	>6.0	---	---	>60	---	Low-------	Moderate.
Chelsea-----------	A	None---------	---	---	>6.0	---	---	>60	---	Low-------	Low.
294C2*, 294D2*:											
Ladoga------------	B	None---------	---	---	>6.0	---	---	>60	---	Moderate	Moderate.
Billett-----------	B	None---------	---	---	>6.0	---	---	>60	---	Low-------	Moderate.
295C2*, 295D2*, 295D3*:											
Clinton----------	B	None---------	---	---	>6.0	---	---	>60	---	Moderate	Moderate.
Lamont-----------	B	None---------	---	---	>6.0	---	---	>60	---	Low-------	Moderate.
Chelsea----------	A	None---------	---	---	>6.0	---	---	>60	---	Low-------	Low.
422---------------- Amana	B	Occasional	Brief------	Feb-Nov	2.0-4.0	Apparent	Nov-Jul	>60	---	High------	Moderate.
424D*, 424D2*, 424D3*, 424E2*:											
Lindley----------	C	None---------	---	---	>6.0	---	---	>60	---	Moderate	Moderate.
Keswick----------	C	None---------	---	---	1.0-3.0	Perched	Nov-Jul	>60	---	High------	Moderate.

See footnote at end of table.

TABLE 17.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydro-logic group	Flooding			High water table			Bedrock		Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hard-ness	Uncoated steel	Concrete
					Ft			In			
425D2------------ Keswick	C	None--------	---	---	1.0-3.0	Perched	Nov-Jul	>60	---	High-----	Moderate.
428B------------- Ely	B	None--------	---	---	2.0-4.0	Apparent	Nov-Jul	>60	---	High-----	Moderate.
430-------------- Ackmore	B	Occasional	Very brief to brief.	Sep-Jun	1.0-3.0	Apparent	Nov-Jul	>60	---	High-----	Low.
453-------------- Tuskeego	C/D	Rare--------	---	---	0-1.0	Apparent	Nov-Jul	>60	---	High-----	Moderate.
484-------------- Lawson	C	Occasional	Brief to long.	Feb-Nov	1.0-3.0	Apparent	Nov-Jul	>60	---	Moderate	Low.
499F------------- Nordness	B	None--------	---	---	>6.0	---	---	8-20	Hard	Low------	Low.
520-------------- Coppock	B	Occasional	Brief-----	Feb-Nov	1.0-3.0	Apparent	Nov-Jul	>60	---	High-----	Moderate.
520B------------- Coppock	B	Rare--------	---	---	1.0-3.0	Apparent	Nov-Jul	>60	---	High-----	Moderate.
539-------------- Perks	A	Occasional	Very brief to brief.	Feb-Nov	>6.0	---	---	>60	---	Low------	Moderate.
570B, 570B2, 570C2, 570C3----- Nira	B	None--------	---	---	4.0-6.0	Apparent	Nov-Jul	>60	---	Moderate	Moderate.
571B, 571B2, 571C2, 571C3----- Hedrick	B	None--------	---	---	4.0-6.0	Apparent	Nov-Jul	>60	---	Moderate	Moderate.
572B, 572C2------- Inton	B	None--------	---	---	4.0-6.0	Apparent	Nov-Jul	>60	---	Moderate	Moderate.
592D2------------ Mystic	C	None--------	---	---	3.0-5.0	Perched	Nov-Jul	>60	---	Moderate	Moderate.
687B------------- Watkins	B	Rare--------	---	---	>6.0	---	---	>60	---	Moderate	Moderate.
688-------------- Koszta	B	Rare--------	---	---	2.0-3.0	Apparent	Nov-Jul	>60	---	Moderate	Moderate.
715*: Nodaway----------	B	Frequent----	Very brief to brief.	Feb-Nov	3.0-5.0	Apparent	Nov-Jul	>60	---	Moderate	Low.

See footnote at end of table.

TABLE 17.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydro-logic group	Flooding			High water table			Bedrock		Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hard-ness	Uncoated steel	Concrete
					Ft			In			
715*:											
Perks	A	Occasional	Very brief to brief.	Feb-Nov	>6.0	---	---	>60	---	Low	Moderate.
729B*:											
Ackmore	B	Occasional	Very brief	Feb-Nov	1.0-3.0	Apparent	Nov-Jul	>60	---	High	Low.
Nodaway	B	Occasional	Very brief	Feb-Nov	3.0-5.0	Apparent	Nov-Jul	>60	---	Moderate	Low.
779 Kalona	C	None	---	---	1.0-2.0	Apparent	Nov-Jul	>60	---	High	Moderate.
792C2, 792D2 Armstrong	C	None	---	---	1.0-3.0	Perched	Nov-Jul	>60	---	High	Moderate.
793B Bertrand	B	Rare	---	---	>6.0	---	---	>60	---	Low	Moderate.
795D2 Ashgrove	D	None	---	---	1.0-3.0	Perched	Nov-Jul	>60	---	High	Moderate.
876B, 876C2 Ladoga	B	None	---	---	>6.0	---	---	>60	---	Moderate	Moderate.
880B, 880C2, 880D2 Clinton	B	None	---	---	>6.0	---	---	>60	---	Moderate	Moderate.
881B Otley	B	None	---	---	>6.0	---	---	>60	---	Moderate	Moderate.
993D2*, 993D3*, 993E2*:											
Gara	C	None	---	---	>6.0	---	---	>60	---	Moderate	Moderate.
Armstrong	C	None	---	---	1.0-3.0	Perched	Nov-Jul	>60	---	High	Moderate.
994D3*:											
Galland	D	None	---	---	3.0-5.0	Perched	Nov-Jul	>60	---	High	Moderate.
Douds	B	None	---	---	4.0-6.0	Apparent	Nov-Jul	>60	---	Moderate	Moderate.
1075 Givin	C	None	---	---	2.0-4.0	Apparent	Nov-Jul	>60	---	High	Moderate.
1180 Keomah	C	None	---	---	2.0-4.0	Apparent	Nov-Jul	>60	---	High	Moderate.

See footnote at end of table.

TABLE 17.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydrologic group	Flooding			High water table			Bedrock		Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness	Uncoated steel	Concrete
					Ft			In			
1280--------------- Mahaska	B	None---------	---	---	2.0-4.0	Apparent	Nov-Jul	>60	---	High------	Moderate.
1354*. Aquents											
1484--------------- Lawson	C	Frequent----	Brief to long.	Feb-Nov	1.0-3.0	Apparent	Nov-Jul	>60	---	Moderate	Low.
2226--------------- Elrin	B	Rare---------	---	---	3.0-5.0	Apparent	Nov-Jul	>60	---	Moderate	Moderate.
2242*:											
Nodaway-----------	B	Frequent----	Very brief to brief.	Feb-Nov	3.0-5.0	Apparent	Nov-Jul	>60	---	Moderate	Low.
Amana-------------	B	Frequent----	Brief------	Feb-Nov	2.0-4.0	Apparent	Nov-Jul	>60	---	High------	Moderate.
5030*. Pits											
5040*. Orthents											

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 18.--CLASSIFICATION OF THE SOILS

[An asterisk in the first column indicates that the soil is a taxadjunct to the series. See text for a description of those characteristics of the soil that are outside the range of the series]

Soil name	Family or higher taxonomic class
Ackmore	Fine-silty, mixed, nonacid, mesic Aeric Fluvaquents
Adair	Fine, montmorillonitic, mesic Aquic Argiudolls
Ainsworth	Fine, montmorillonitic, mesic Typic Hapludalfs
Amana	Fine-silty, mixed, mesic Aquic Hapludolls
Aquents	Loamy, mixed, nonacid, mesic Fluvaquents
Armstrong	Fine, montmorillonitic, mesic Aquollic Hapludalfs
Ashgrove	Fine, montmorillonitic, mesic, sloping Aeric Ochraqualfs
Bertrand	Fine-silty, mixed, mesic Typic Hapludalfs
*Billett	Coarse-loamy, mixed, mesic Mollic Hapludalfs
Bremer	Fine, montmorillonitic, mesic Typic Argiaquolls
Chelsea	Mixed, mesic Alfic Udipsamments
Clarinda	Fine, montmorillonitic, mesic, sloping Typic Argiaquolls
Clinton	Fine, montmorillonitic, mesic Typic Hapludalfs
Colo	Fine-silty, mixed, mesic Cumulic Haplaquolls
Coppock	Fine-silty, mixed, mesic Mollic Ochraqualfs
Dickinson	Coarse-loamy, mixed, mesic Typic Hapludolls
Douds	Fine-loamy, mixed, mesic Typic Hapludalfs
Elrin	Coarse-loamy, mixed, mesic Aquic Hapludolls
Ely	Fine-silty, mixed, mesic Cumulic Hapludolls
Fayette	Fine-silty, mixed, mesic Typic Hapludalfs
Galland	Fine, montmorillonitic, mesic Aquic Hapludalfs
Gara	Fine-loamy, mixed, mesic Mollic Hapludalfs
Givin	Fine, montmorillonitic, mesic Udollic Ochraqualfs
Hedrick	Fine-silty, mixed, mesic Mollic Hapludalfs
Humeston	Fine, montmorillonitic, mesic Argiaquic Argialbolls
Inton	Fine-silty, mixed, mesic Typic Hapludalfs
Jackson	Fine-silty, mixed, mesic Typic Hapludalfs
Kalona	Fine, montmorillonitic, mesic Typic Haplaquolls
Keomah	Fine, montmorillonitic, mesic Aeric Ochraqualfs
Keswick	Fine, montmorillonitic, mesic Aquic Hapludalfs
Koszta	Fine-silty, mixed, mesic Udollic Ochraqualfs
Ladoga	Fine, montmorillonitic, mesic Mollic Hapludalfs
Lamont	Coarse-loamy, mixed, mesic Typic Hapludalfs
Lawson	Fine-silty, mixed, mesic Cumulic Hapludolls
Lindley	Fine-loamy, mixed, mesic Typic Hapludalfs
Mahaska	Fine, montmorillonitic, mesic Aquic Argiudolls
Mystic	Fine, montmorillonitic, mesic Aquollic Hapludalfs
Nevin	Fine-silty, mixed, mesic Aquic Argiudolls
Nira	Fine-silty, mixed, mesic Typic Hapludolls
Nodaway	Fine-silty, mixed, nonacid, mesic Mollic Udifluvents
Nordness	Loamy, mixed, mesic Lithic Hapludalfs
Okaw	Fine, montmorillonitic, mesic Typic Albaqualfs
Orthents	Loamy, mixed, nonacid, mesic Typic Udorthents
Otley	Fine, montmorillonitic, mesic Typic Argiudolls
Perks	Mixed, mesic Typic Udipsamments
Rinda	Fine, montmorillonitic, mesic, sloping Mollic Ochraqualfs
Rubio	Fine, montmorillonitic, mesic Mollic Albaqualfs
Shelby	Fine-loamy, mixed, mesic Typic Argiudolls
Sparta	Sandy, mixed, mesic Entic Hapludolls
*Sperry	Fine, montmorillonitic, mesic Typic Argialbolls
Taintor	Fine, montmorillonitic, mesic Typic Argiaquolls
Tuskeego	Fine, montmorillonitic, mesic Mollic Ochraqualfs
Watkins	Fine-silty, mixed, mesic Mollic Hapludalfs
Wiota	Fine-silty, mixed, mesic Typic Argiudolls
Zook	Fine, montmorillonitic, mesic Cumulic Haplaquolls

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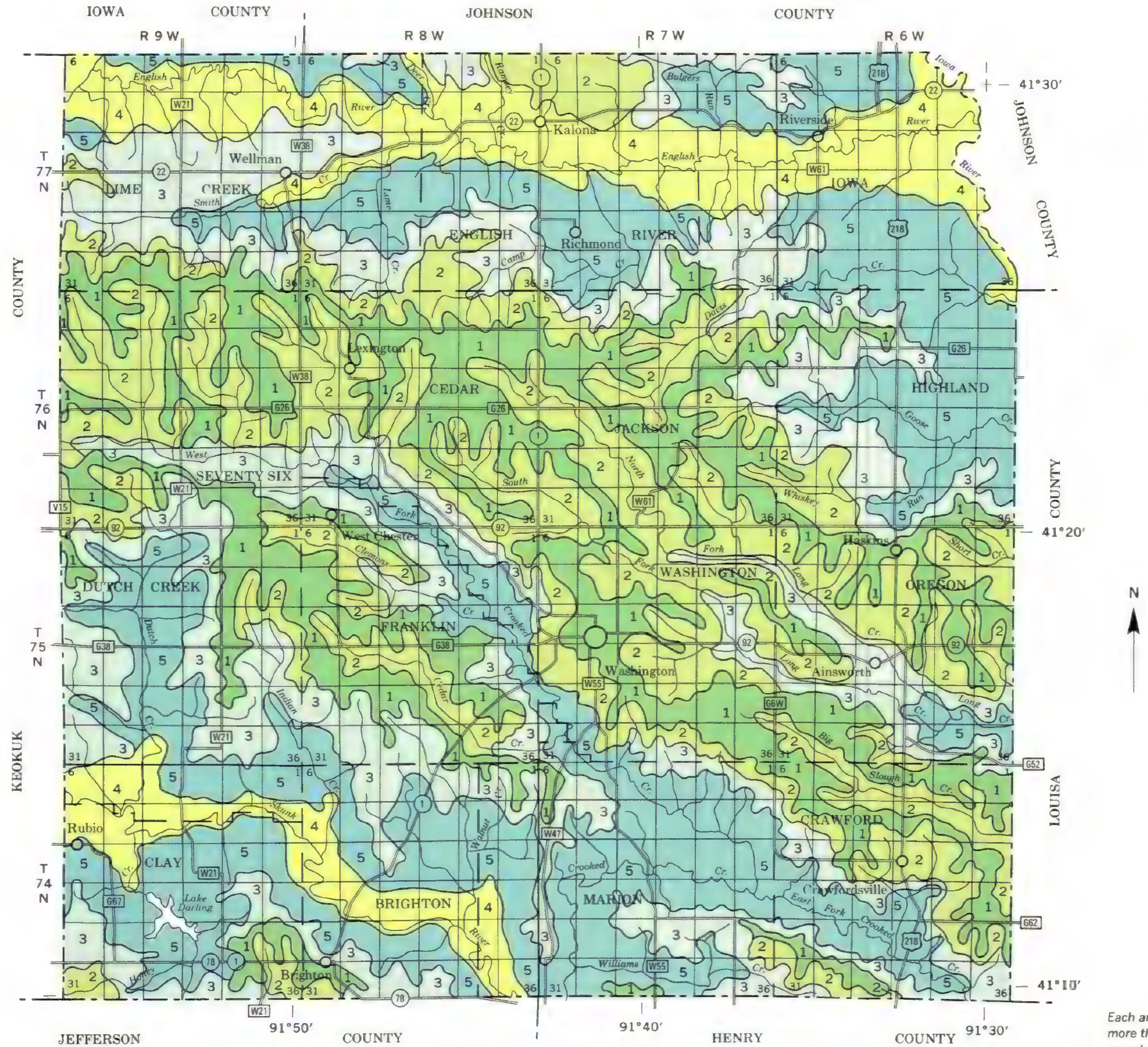


LEGEND*

1 MAHASKA-TAINTOR-KALONA association: Nearly level, somewhat poorly drained and poorly drained, silty soils formed in loess on uplands

2 OTLEY-NIRA association: Gently sloping and moderately sloping, moderately well drained, silty soils formed in loess on uplands

3 LADOGA-HEDRICK-GARA association: Gently sloping to moderately steep, moderately well drained and well drained, silty and loamy soils formed in loess or glacial till on uplands

4 NODAWAY-COLO-TUSKEEGO association: Nearly level, moderately well drained and poorly drained, silty soils formed in alluvium on bottom land and stream terraces

5 CLINTON-LINDLEY association: Gently sloping to very steep, moderately well drained and well drained, silty and loamy soils formed in loess or glacial till on uplands

*Texture terms in the descriptive headings refer to the surface layer of the major soils in the associations.

COMPILED 1983

U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
IOWA AGRICULTURE AND HOME ECONOMICS EXPERIMENT STATION
COOPERATIVE EXTENSION SERVICE, IOWA STATE UNIVERSITY
DEPARTMENT OF SOIL CONSERVATION, STATE OF IOWA

GENERAL SOIL MAP

WASHINGTON COUNTY, IOWA

Scale 1:190,080

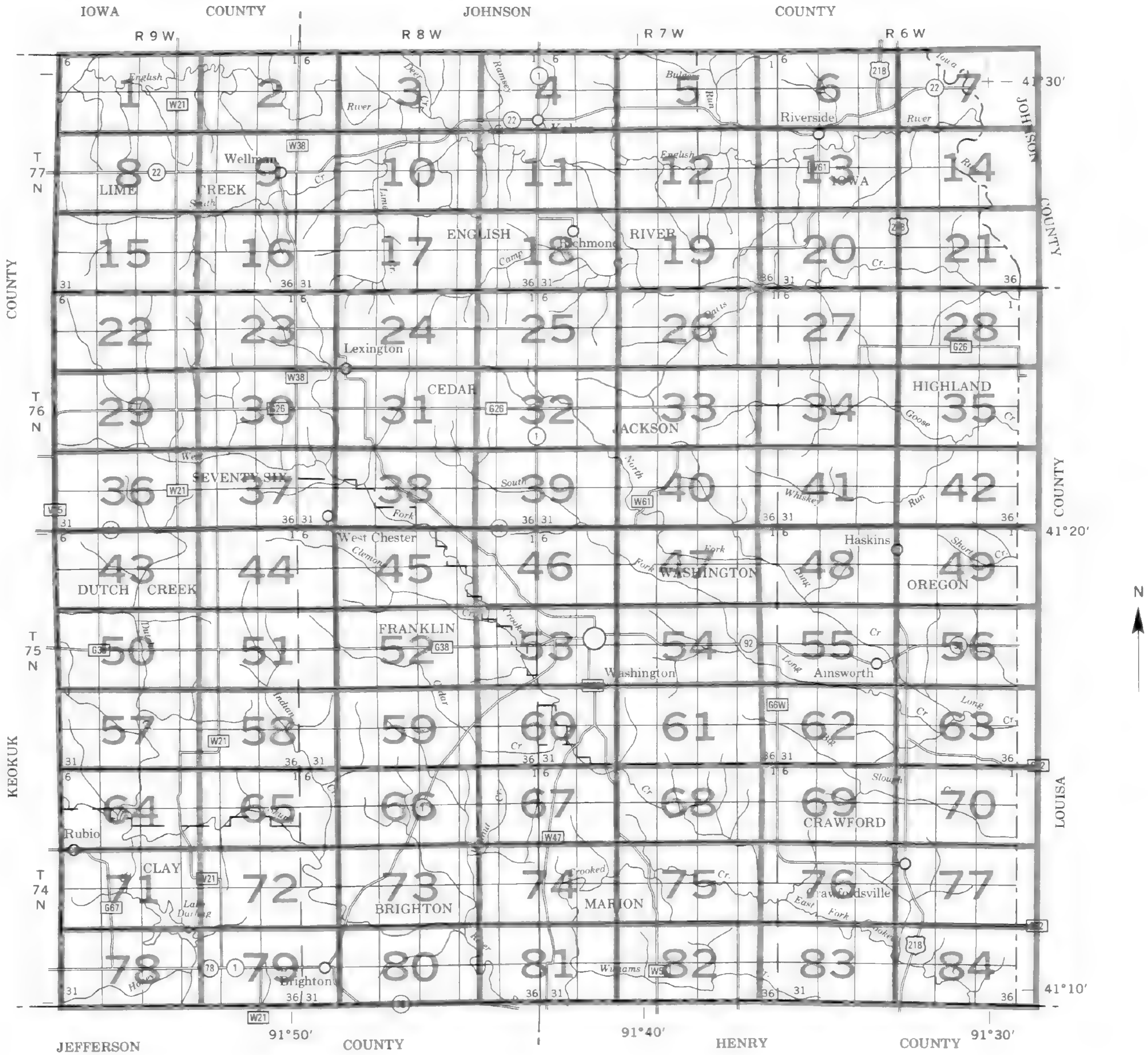
1 0 1 2 3 Miles

1 0 3 6 Km

Each area outlined on this map consists of more than one kind of soil. The map is thus meant for general planning rather than a basis for decisions on the use of specific tracts.

SECTIONALIZED TOWNSHIP

6	5	4	3	2	1
7	8	9	10	11	12
18	17	16	15	14	13
19	20	21	22	23	24
30	29	28	27	26	25
31	32	33	34	35	36



Original text from each individual map sheet read:

This map is compiled on 1976 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

INDEX TO MAP SHEETS

WASHINGTON COUNTY, IOWA

Scale 1:190,080

1 0 1 2 3 Miles

1 0 3 6 Km

SECTIONALIZED TOWNSHIP

6	5	4	3	2	1
7	8	9	10	11	12
18	17	16	15	14	13
19	20	21	22	23	24
30	29	28	27	26	25
31	32	33	34	35	36

SOIL LEGEND

Map symbols consist of numbers or a combination of numbers and a letter. The initial numbers represent the kind of soil. A capital letter following these numbers indicates the class of slope. Symbols without a slope letter are for nearly level soils or miscellaneous areas. A final number of 2 following the slope letter indicates that the soil is moderately eroded and 3 that it is severely eroded.

SYMBOL	NAME
7B	Wiota silty clay loam, 1 to 5 percent slopes
11B	Colo-Ely silty clay loams, 2 to 5 percent slopes
24D2	Shelby loam, 9 to 14 percent slopes, moderately eroded
41C	Sparta loamy fine sand, 2 to 9 percent slopes
43	Bremer silty clay loam, 0 to 2 percent slopes
54	Zook silty clay loam, 0 to 2 percent slopes
58D2	Douds loam, 9 to 14 percent slopes, moderately eroded
58E2	Douds loam, 14 to 18 percent slopes, moderately eroded
65D	Lindley loam, 9 to 14 percent slopes
65D2	Lindley loam, 9 to 14 percent slopes, moderately eroded
65E	Lindley loam, 14 to 18 percent slopes
65E2	Lindley loam, 14 to 18 percent slopes, moderately eroded
65F	Lindley loam, 18 to 25 percent slopes
65F2	Lindley loam, 18 to 25 percent slopes, moderately eroded
65G	Lindley loam, 25 to 40 percent slopes
74	Rubio silt loam, 0 to 2 percent slopes
75	Givin silt loam, 0 to 2 percent slopes
76B	Ladoga silt loam, 2 to 5 percent slopes
76B2	Ladoga silt loam, 2 to 5 percent slopes, moderately eroded
76C	Ladoga silt loam, 5 to 9 percent slopes
76C2	Ladoga silt loam, 5 to 9 percent slopes, moderately eroded
76C3	Ladoga silty clay loam, 5 to 9 percent slopes, severely eroded
76D2	Ladoga silt loam, 9 to 14 percent slopes, moderately eroded
76D3	Ladoga silty clay loam, 9 to 14 percent slopes, severely eroded
80B	Clinton silt loam, 2 to 5 percent slopes
80C	Clinton silt loam, 5 to 9 percent slopes
80C2	Clinton silt loam, 5 to 9 percent slopes, moderately eroded
80C3	Clinton silty clay loam, 5 to 9 percent slopes, severely eroded
80D	Clinton silt loam, 9 to 14 percent slopes
80D2	Clinton silt loam, 9 to 14 percent slopes, moderately eroded
80D3	Clinton silty clay loam, 9 to 14 percent slopes, severely eroded
87B	Colo-Zook silty clay loams, 0 to 3 percent slopes
88	Nevin silty clay loam, 0 to 2 percent slopes
93D2	Shelby-Adair complex, 9 to 14 percent slopes, moderately eroded
93D3	Shelby-Adair clay loams, 9 to 14 percent slopes, severely eroded
122	Sperry silt loam, 0 to 2 percent slopes
133	Colo silty clay loam, 0 to 2 percent slopes
133+	Colo silt loam, overwash, 0 to 2 percent slopes
163E	Fayette silt loam, 14 to 18 percent slopes
163E2	Fayette silt loam, 14 to 18 percent slopes, moderately eroded
163E3	Fayette silty clay loam, 14 to 18 percent slopes, severely eroded
163F	Fayette silt loam, 18 to 25 percent slopes
163G	Fayette silt loam, 25 to 40 percent slopes
175	Dickinson sandy loam, 0 to 2 percent slopes
179D2	Gara loam, 9 to 14 percent slopes, moderately eroded
179E2	Gara loam, 14 to 18 percent slopes, moderately eroded
180	Keomah silt loam, 0 to 2 percent slopes
192C2	Adair silty clay loam, 5 to 9 percent slopes, moderately eroded
192D2	Adair silty clay loam, 9 to 14 percent slopes, moderately eroded
219	Jackson silt loam, 0 to 2 percent slopes
220	Nodaway silt loam, 0 to 2 percent slopes
222C2	Clarinda silty clay loam, 5 to 9 percent slopes, moderately eroded
222C3	Clarinda silty clay loam, 5 to 9 percent slopes, severely eroded
222D2	Clarinda silty clay loam, 9 to 14 percent slopes, moderately eroded
222D3	Clarinda silty clay loam, 9 to 14 percent slopes, severely eroded
223C2	Rinda silty clay loam, 5 to 9 percent slopes, moderately eroded
223D2	Rinda silty clay loam, 9 to 14 percent slopes, moderately eroded
263	Okaw silt loam, 0 to 2 percent slopes
264B	Ainsworth silt loam, 1 to 5 percent slopes
269	Humeston silty clay loam, 0 to 2 percent slopes
279	Taintor silty clay loam, 0 to 2 percent slopes
280	Mahaska silty clay loam, 0 to 2 percent slopes
281B	Otley silty clay loam, 2 to 5 percent slopes
281B2	Otley silty clay loam, 2 to 5 percent slopes, moderately eroded
281C	Otley silty clay loam, 5 to 9 percent slopes
281C2	Otley silty clay loam, 5 to 9 percent slopes, moderately eroded
281C3	Otley silty clay loam, 5 to 9 percent slopes, severely eroded
281D2	Otley silty clay loam, 9 to 14 percent slopes, moderately eroded
281D3	Otley silty clay loam, 9 to 14 percent slopes, severely eroded
293E2	Fayette-Lamont-Chelsea complex, 14 to 25 percent slopes, moderately eroded
294C2	Ladoga-Billett complex, 5 to 9 percent slopes, moderately eroded
294D2	Ladoga-Billett complex, 9 to 14 percent slopes, moderately eroded
295C2	Clinton-Lamont-Chelsea complex, 5 to 9 percent slopes, moderately eroded
295D2	Clinton-Lamont-Chelsea complex, 9 to 14 percent slopes, moderately eroded
295D3	Clinton-Lamont-Chelsea complex, 9 to 14 percent slopes, severely eroded
422	Amana silt loam, 0 to 2 percent slopes
424D	Lindley-Keswick complex, 9 to 14 percent slopes
424D2	Lindley-Keswick complex, 9 to 14 percent slopes, moderately eroded
424D3	Lindley-Keswick clay loams, 9 to 14 percent slopes, severely eroded
424E2	Lindley-Keswick complex, 14 to 18 percent slopes, moderately eroded
425D2	Keswick silt loam, 9 to 14 percent slopes, moderately eroded
428B	Ely silty clay loam, 2 to 5 percent slopes
430	Ackmore silt loam, 0 to 2 percent slopes
453	Tuskeego silt loam, 0 to 2 percent slopes
484	Lawson silt loam, 0 to 2 percent slopes
499F	Nordness silt loam, 14 to 25 percent slopes
520	Coppock silt loam, 0 to 2 percent slopes
520B	Coppock silt loam, 2 to 5 percent slopes
539	Perks sandy loam, 0 to 3 percent slopes
570B	Nira silty clay loam, 2 to 5 percent slopes
570B2	Nira silty clay loam, 2 to 5 percent slopes, moderately eroded
570C2	Nira silty clay loam, 5 to 9 percent slopes, moderately eroded
570C3	Nira silty clay loam, 5 to 9 percent slopes, severely eroded
571B	Hedrick silt loam, 2 to 5 percent slopes
571B2	Hedrick silt loam, 2 to 5 percent slopes, moderately eroded
571C2	Hedrick silt loam, 5 to 9 percent slopes, moderately eroded
571C3	Hedrick silty clay loam, 5 to 9 percent slopes, severely eroded
572B	Inton silt loam, 2 to 5 percent slopes
572C2	Inton silt loam, 5 to 9 percent slopes, moderately eroded
592D2	Mystic loam, 9 to 14 percent slopes, moderately eroded
687B	Watkins silt loam, 1 to 5 percent slopes
688	Koszta silt loam, 0 to 2 percent slopes
715	Nodaway-Perks complex, 0 to 3 percent slopes
729B	Ackmore-Nodaway silt loams, 2 to 5 percent slopes
779	Kalona silty clay loam, 0 to 2 percent slopes
792C2	Armstrong silt loam, 5 to 9 percent slopes, moderately eroded
792D2	Armstrong silt loam, 9 to 14 percent slopes, moderately eroded
793B	Bertrand silt loam, 1 to 5 percent slopes
795D2	Ashgrove silt loam, 9 to 14 percent slopes, moderately eroded
876B	Ladoga silt loam, benches, 2 to 5 percent slopes
876C2	Ladoga silt loam, benches, 5 to 9 percent slopes, moderately eroded
880B	Clinton silt loam, benches, 2 to 5 percent slopes
880C2	Clinton silt loam, benches, 5 to 9 percent slopes, moderately eroded
880D2	Clinton silt loam, benches, 9 to 14 percent slopes, moderately eroded
881B	Otley silty clay loam, benches, 2 to 5 percent slopes
993D2	Gara-Armstrong complex, 9 to 14 percent slopes, moderately eroded
993D3	Gara-Armstrong clay loams, 9 to 14 percent slopes, severely eroded
993E2	Gara-Armstrong complex, 14 to 18 percent slopes, moderately eroded
994D3	Galland-Douds clay loams, 9 to 14 percent slopes, severely eroded
1075	Givin silt loam, benches, 1 to 3 percent slopes
1180	Keomah silt loam, benches, 1 to 3 percent slopes
1280	Mahaska silty clay loam, benches, 1 to 3 percent slopes
1354	Aquents, ponded
1484	Lawson silt loam, channeled, 0 to 2 percent slopes
2226	Elrin loam, 0 to 2 percent slopes
2242	Nodaway-Amana silt loams, 0 to 2 percent slopes
5030	Pits, quarries
5040	Orthents, loamy

CONVENTIONAL AND SPECIAL SYMBOLS LEGEND

CULTURAL FEATURES

BOUNDARIES

- County or parish
- Reservation (national forest or park, state forest or park, and large airport)
- Field sheet matchline & neatline

AD HOC BOUNDARY (label)

- Small airport, airfield, park, or cemetery — Davis Airstrip

STATE COORDINATE TICK

LAND DIVISION CORNERS (sections and land grants)

ROADS

- Divided (median shown if scale permits)
- Other roads

ROAD EMBLEMS & DESIGNATIONS

- Federal — 410
- State — 52

RAILROAD

LEVEES

- Without road

DAMS

- Large (to scale)
- Medium or small — water

PITS

- Gravel pit
- Mine or quarry

MISCELLANEOUS CULTURAL FEATURES

- Farmstead, house (omit in urban areas)
- Church
- School

WATER FEATURES

DRAINAGE

- Perennial, double line
- Perennial, single line
- Intermittent
- Crossable with tillage implements
- Not crossable with tillage implements
- Drainage end
- Canals or ditches
- Drainage and/or irrigation

LAKES, PONDS AND RESERVOIRS

- Perennial — water, w
- Intermittent — int, i

MISCELLANEOUS WATER FEATURES

- Wet spot

SPECIAL SYMBOLS FOR SOIL SURVEY

SOIL DELINEATIONS AND SYMBOLS — 279, 281B

ESCARPMENTS

- Bedrock (points down slope)
- Other than bedrock (points down slope)

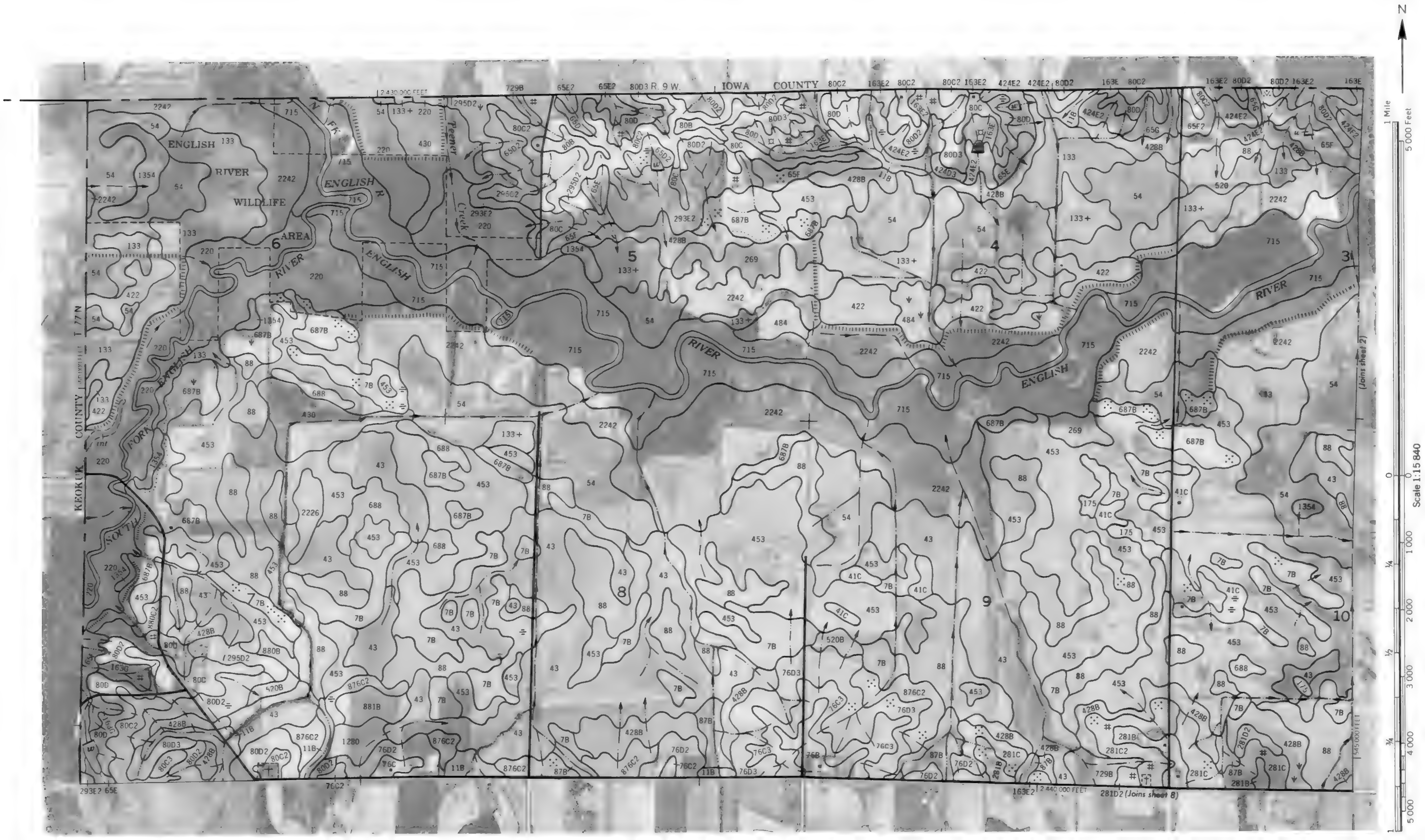
SHORT STEEP SLOPE

GULLY

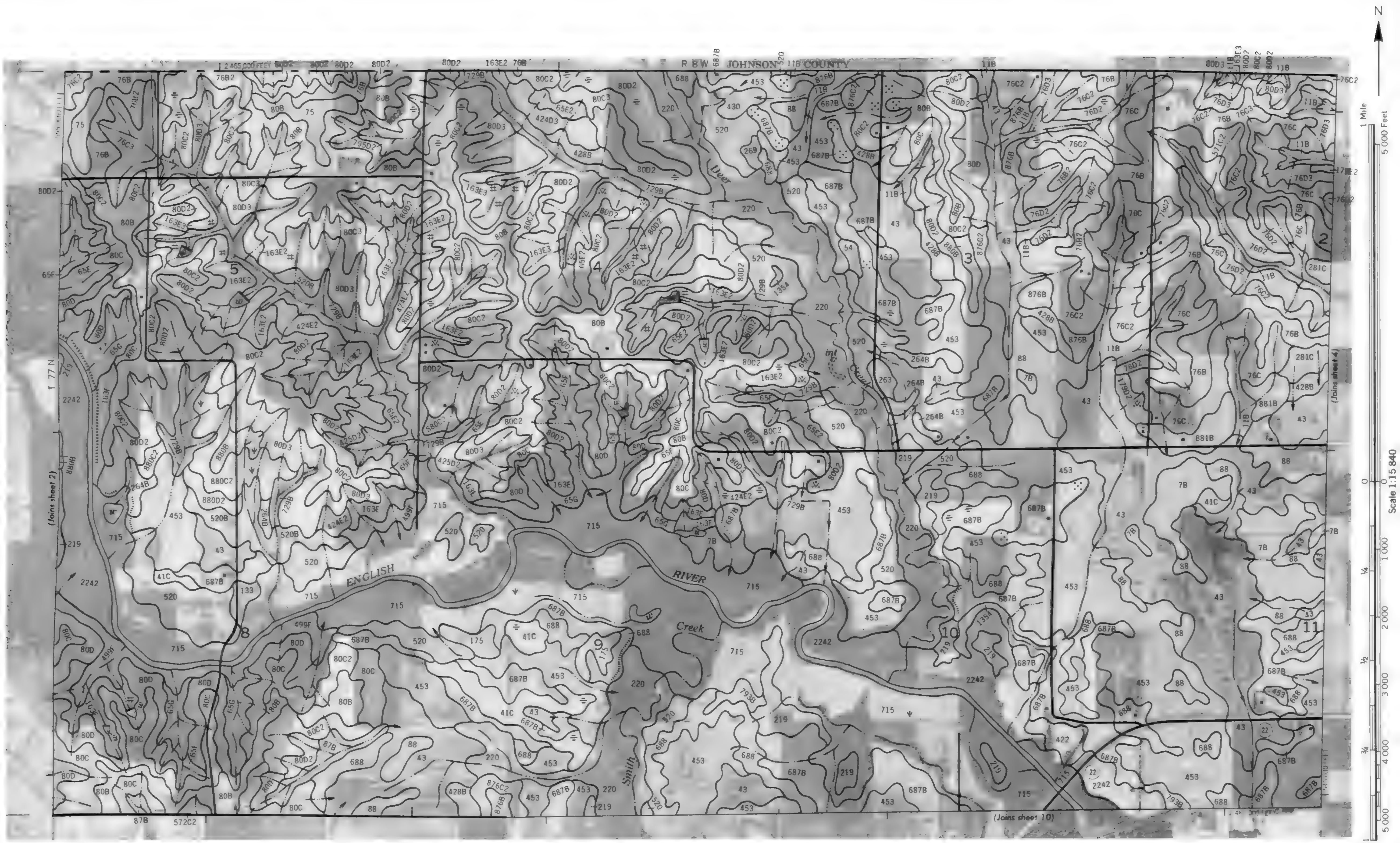
SOIL SAMPLE SITE — S

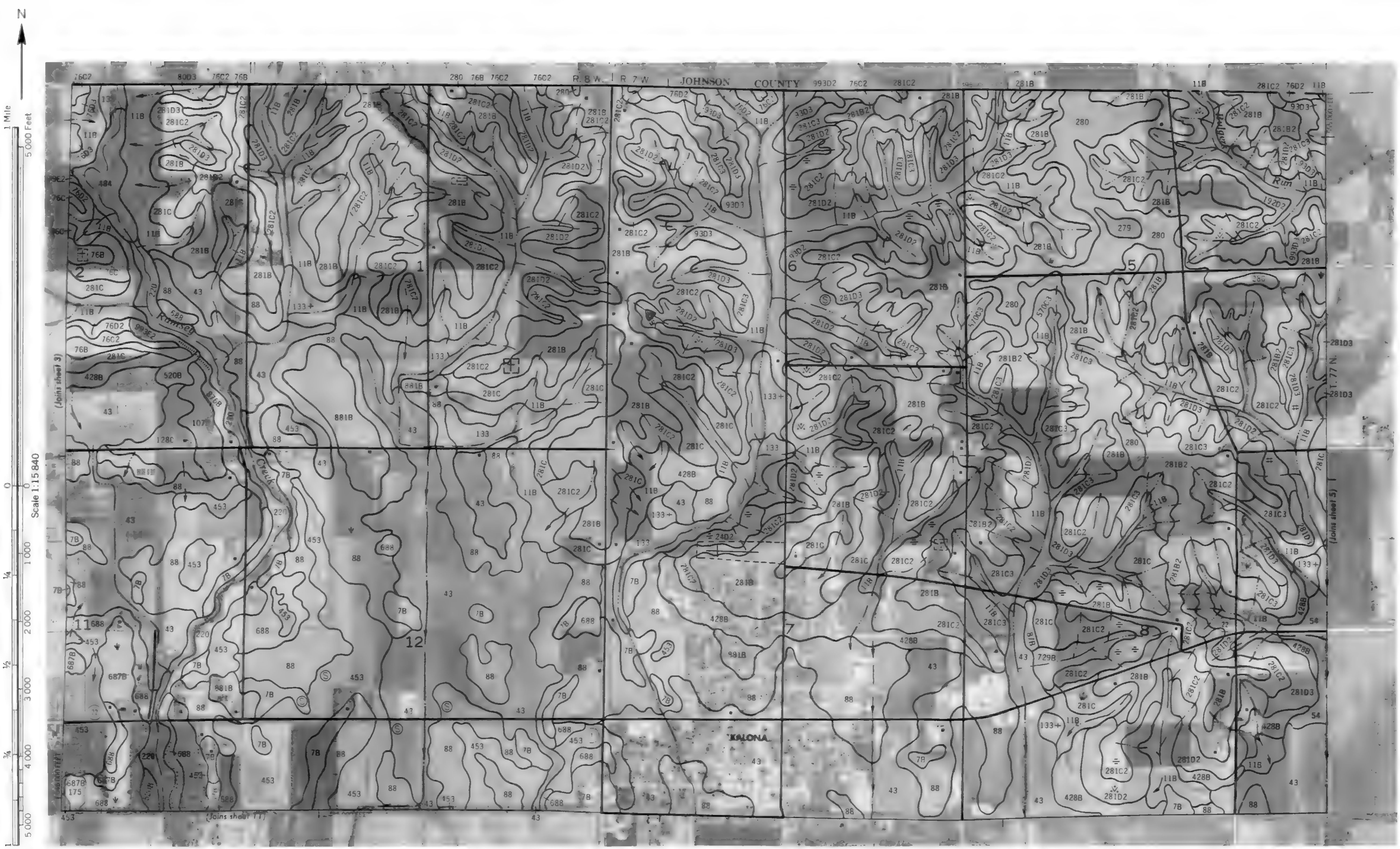
MISCELLANEOUS (each symbol represents 2 acres or less)

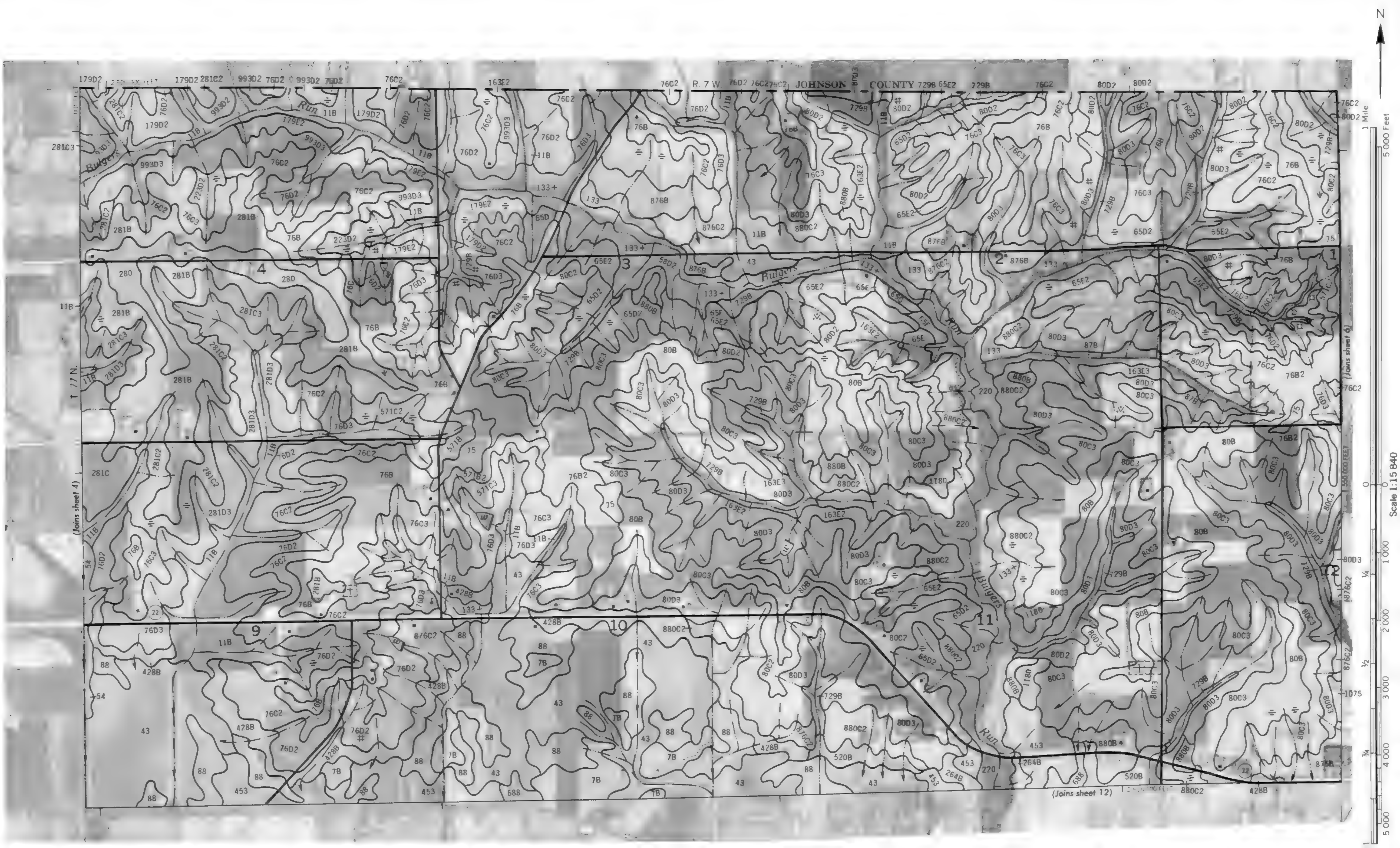
- Rock outcrop
- Sandy spot
- Severely eroded spot
- Gray clay spot
- Douds spot
- Sperry spot
- Red clay spot
- Galland spot
- Glacial till outcrop — #
- Sewage lagoon — S.L.

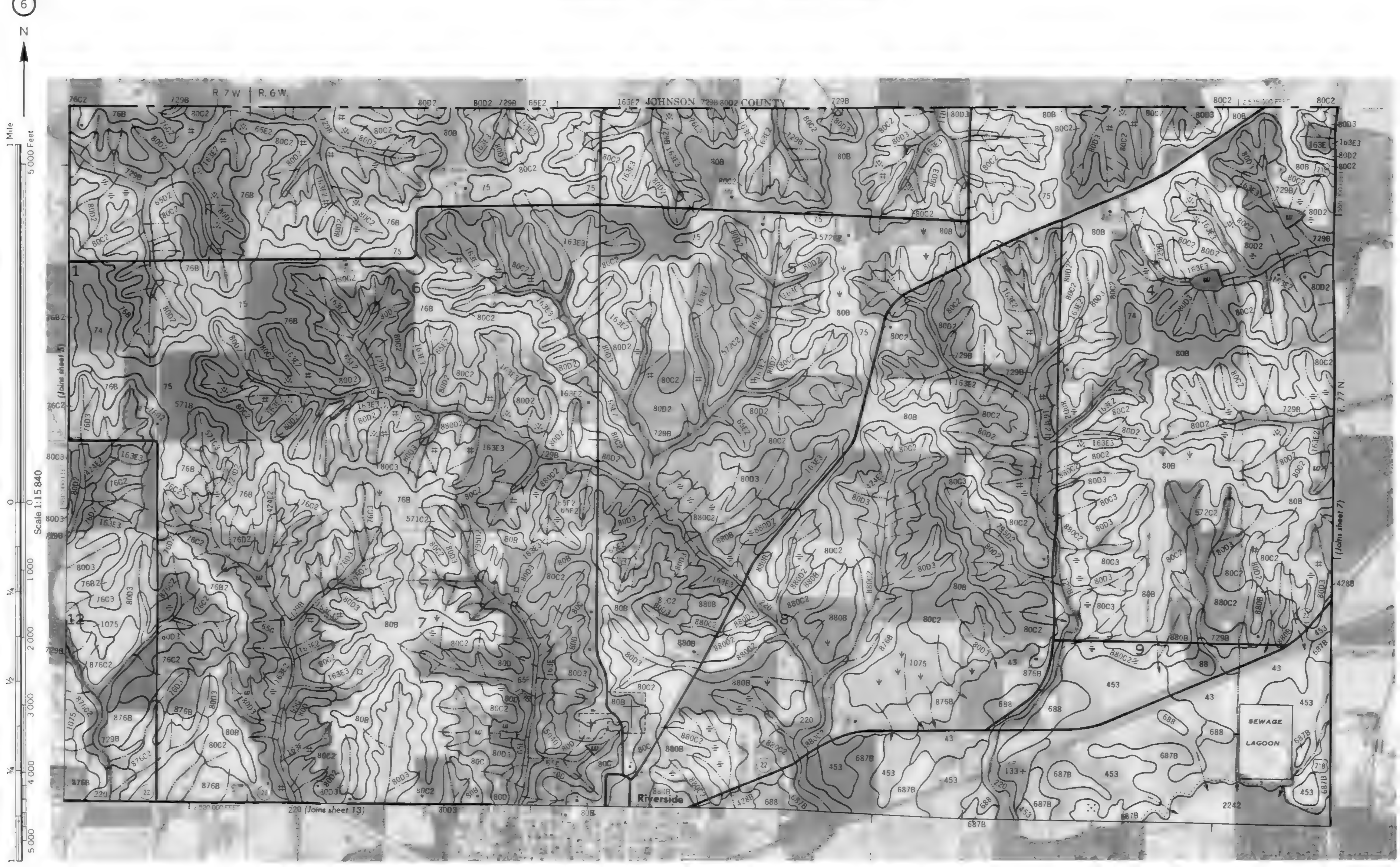

N
IOWA COUNTY
R. 9 W.
2 430 000 FEET
KEOKUK COUNTY
T 77 N
ENGLISH RIVER WILDLIFE AREA
ENGLISH RIVER
N FK ENGLISH R
SOUTH FORK ENGLISH
Peemor Creek
(Joins sheet 2)
281D2 (Joins sheet 8)
2 440 000 FEET
545 000 FEET
1 Mile
5 000 Feet
Scale 1:15 840

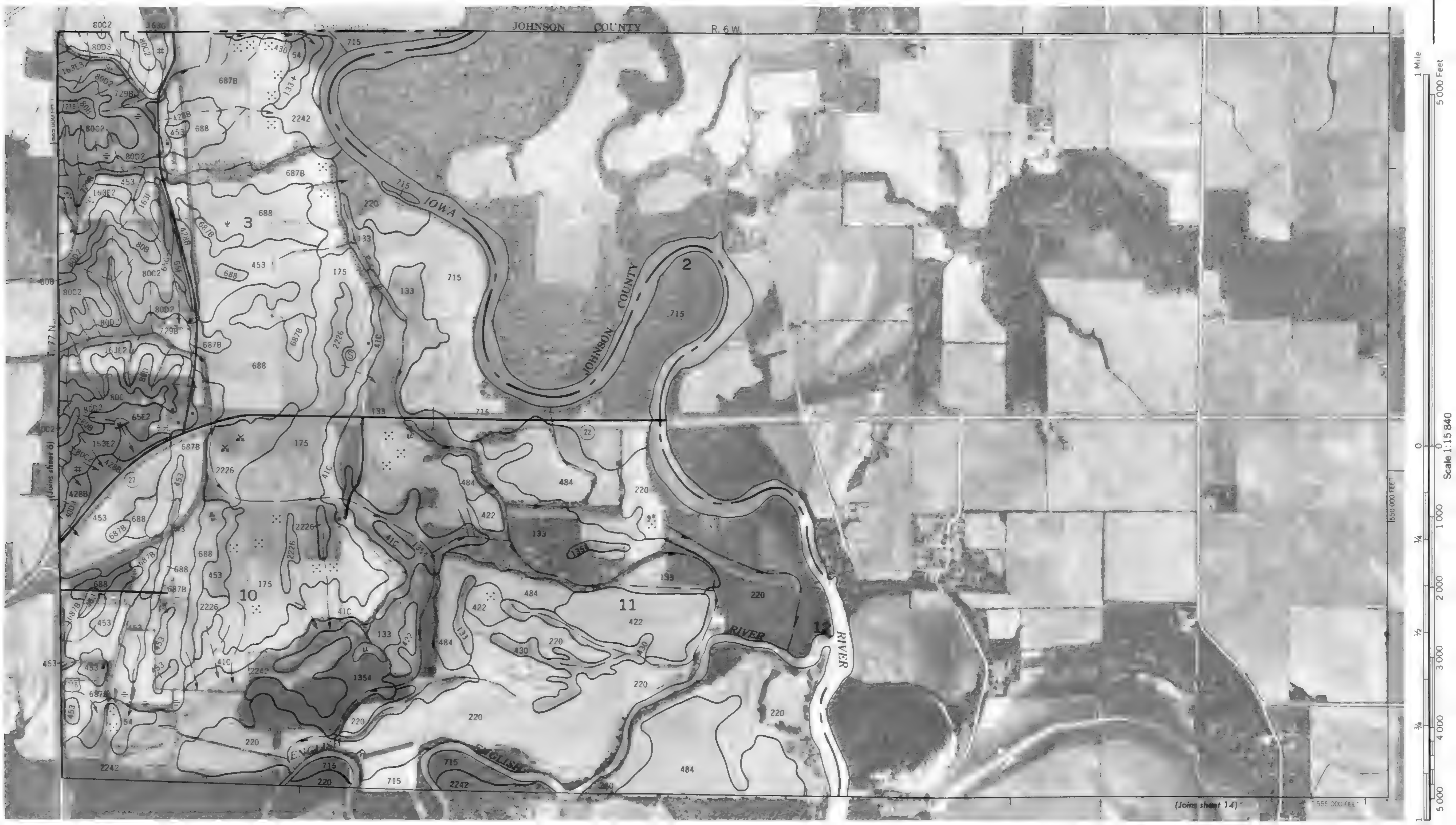

N
1 Mile
5 000 Feet
Scale 1:15 840
R 9 W
R 8 W
IOWA COUNTY
JOHNSON COUNTY
ENGLISH RIVER
Birch
Creek
water
Daytonville
T 77 N
(Joins sheet 1)
(Joins sheet 9)
2 445 000 FEET

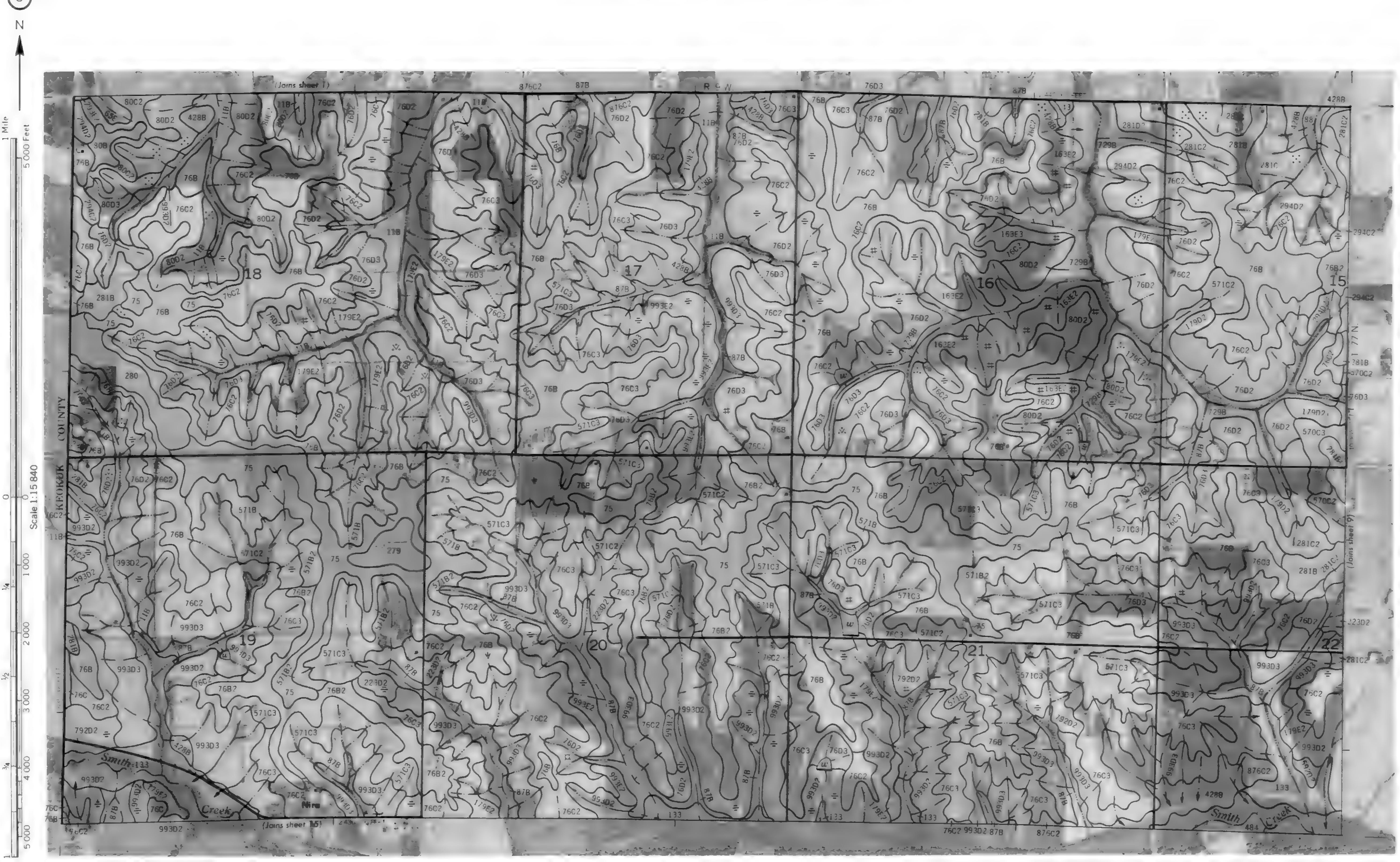

JOHNSON COUNTY
R 8 W
T 77 N
ENGLISH RIVER
Deer Creek
Smith Creek
(Joins sheet 2)
(Joins sheet 4)
(Joins sheet 10)
N
1 Mile
5 000 Feet
Scale 1:15 840
0
1 000
2 000
3 000
4 000
5 000
¼
½
¾

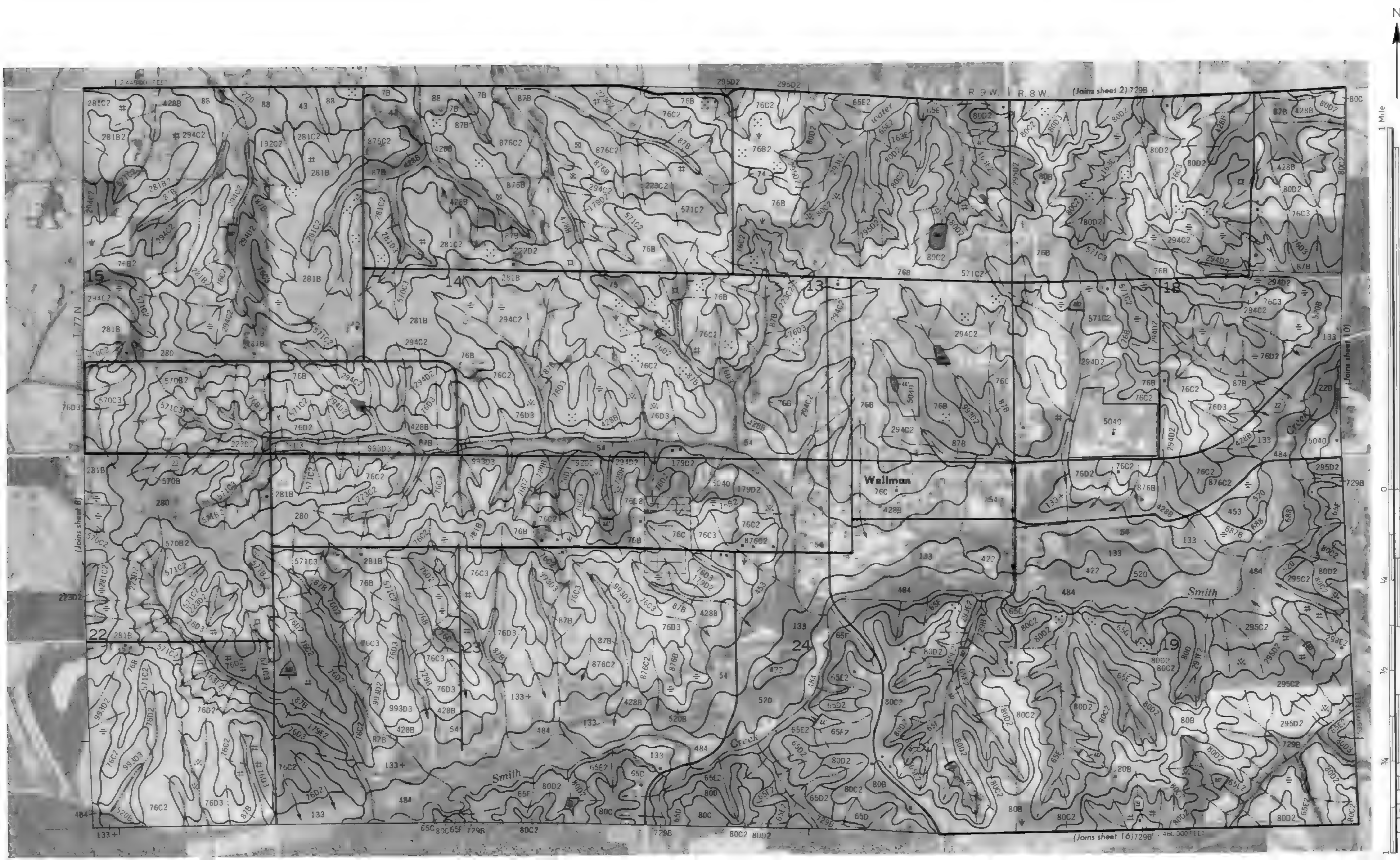

4
N
1 Mile
5 000 Feet
Scale 1:15 840
JOHNSON COUNTY
R. 8 W.
R. 7 W.
T. 77 N.
KALONA
Ramsey
Creek
Run
(Joins sheet 3)
(Joins sheet 5)
(Joins sheet 11)
1
2
5
6
7
8
11
12


5
N
JOHNSON COUNTY
R. 7 W.
T. 77 N.
Bulgers Run
(Joins sheet 4)
(Joins sheet 6)
(Joins sheet 12)
1 Mile
5 000 Feet
Scale 1:15 840
1
2
3
4
9
10
11
12

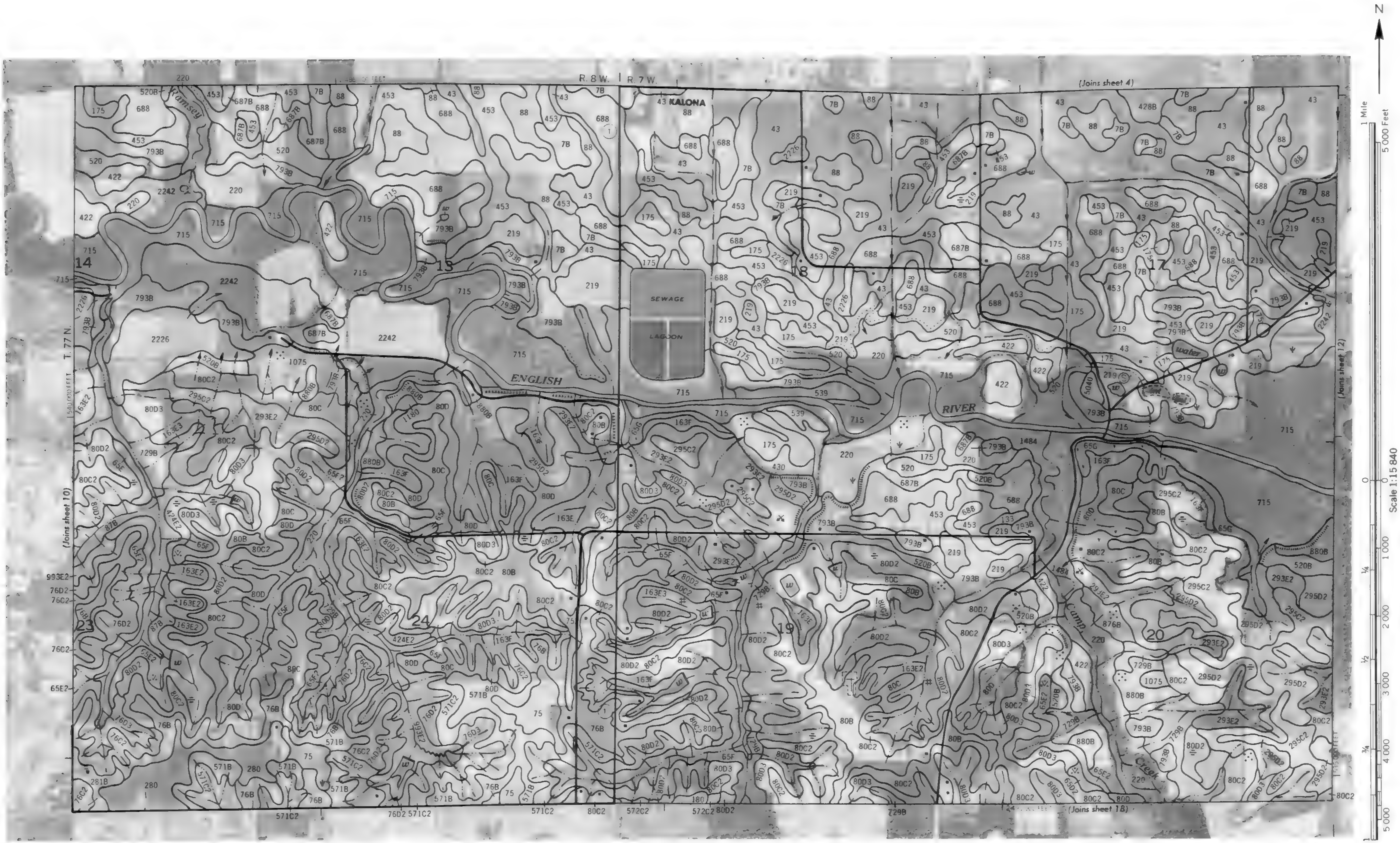

6
N
1 Mile
5 000 Feet
Scale 1:15 840
0
1 000
2 000
3 000
4 000
5 000
¼
½
¾
R. 7 W.
R. 6 W.
JOHNSON COUNTY
T. 77 N.
(Joins sheet 5)
(Joins sheet 7)
220 (Joins sheet 13)
Riverside
SEWAGE LAGOON
1
4
5
6
7
8
9
12

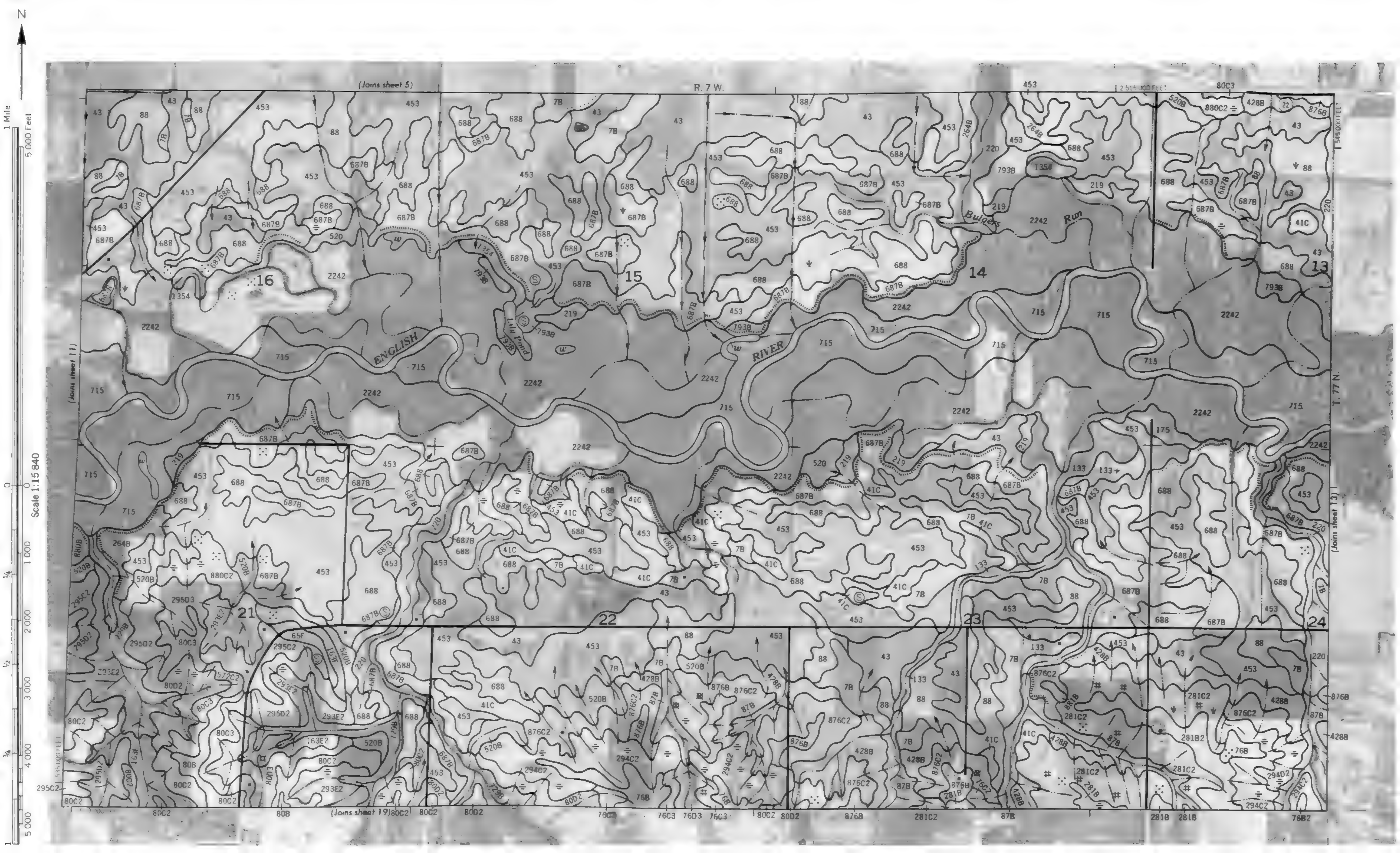

7
N
JOHNSON COUNTY
R. 6 W.
T. 77 N.
IOWA RIVER
JOHNSON COUNTY
ENGLISH RIVER
(Joins sheet 6)
(Joins sheet 14)
550 000 FEET
555 000 FEET
1 Mile
5 000 Feet
Scale 1:15 840

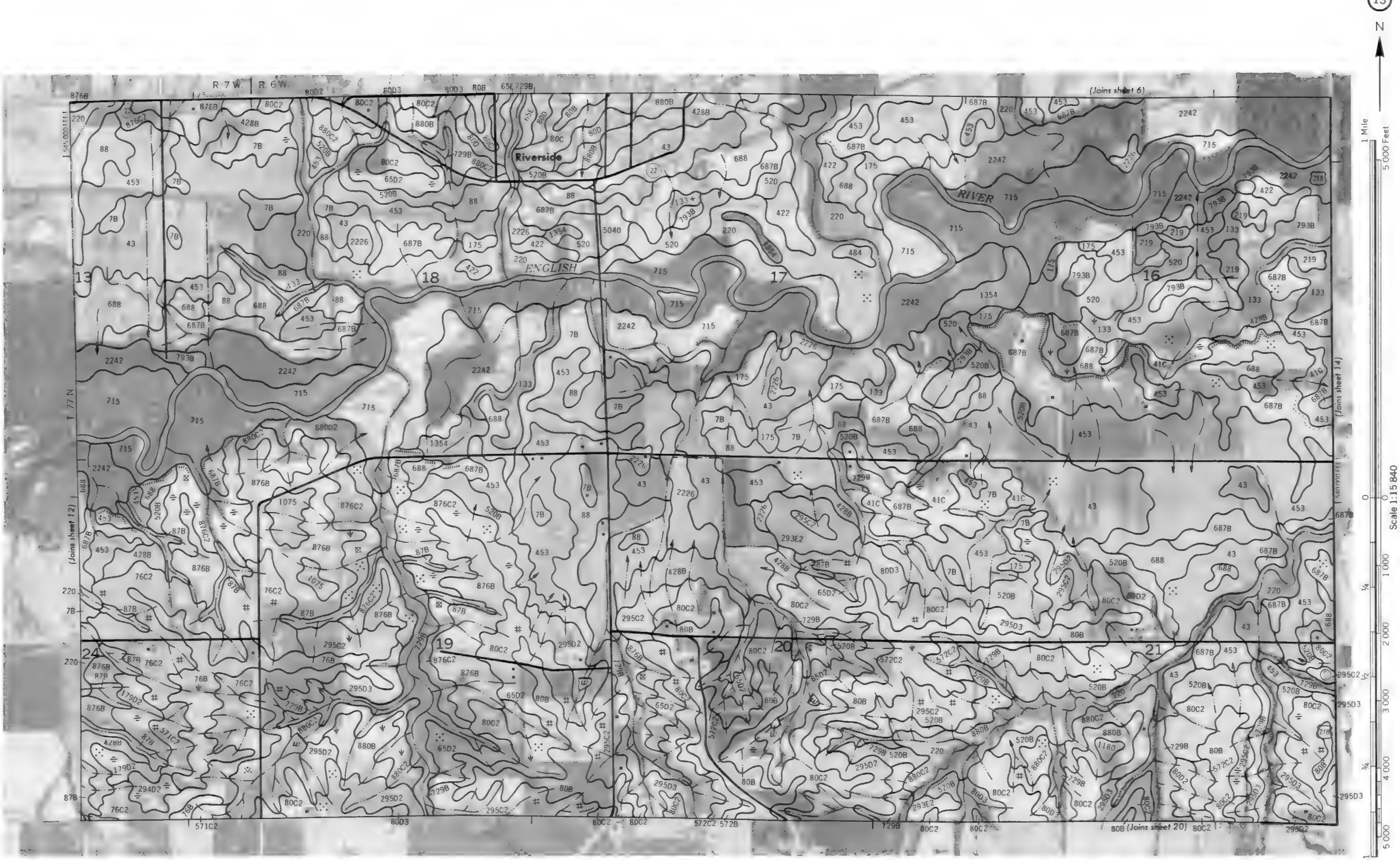

N
1 Mile
5 000 Feet
Scale 1:15 840
0
1 000
2 000
3 000
4 000
5 000
¼
½
¾
(Joins sheet 7)
(Joins sheet 15)
(Joins sheet 9)
R 9 W.
T 77 N.
KEOKUK COUNTY
18
17
16
15
19
20
21
22
Smith Creek
Nira

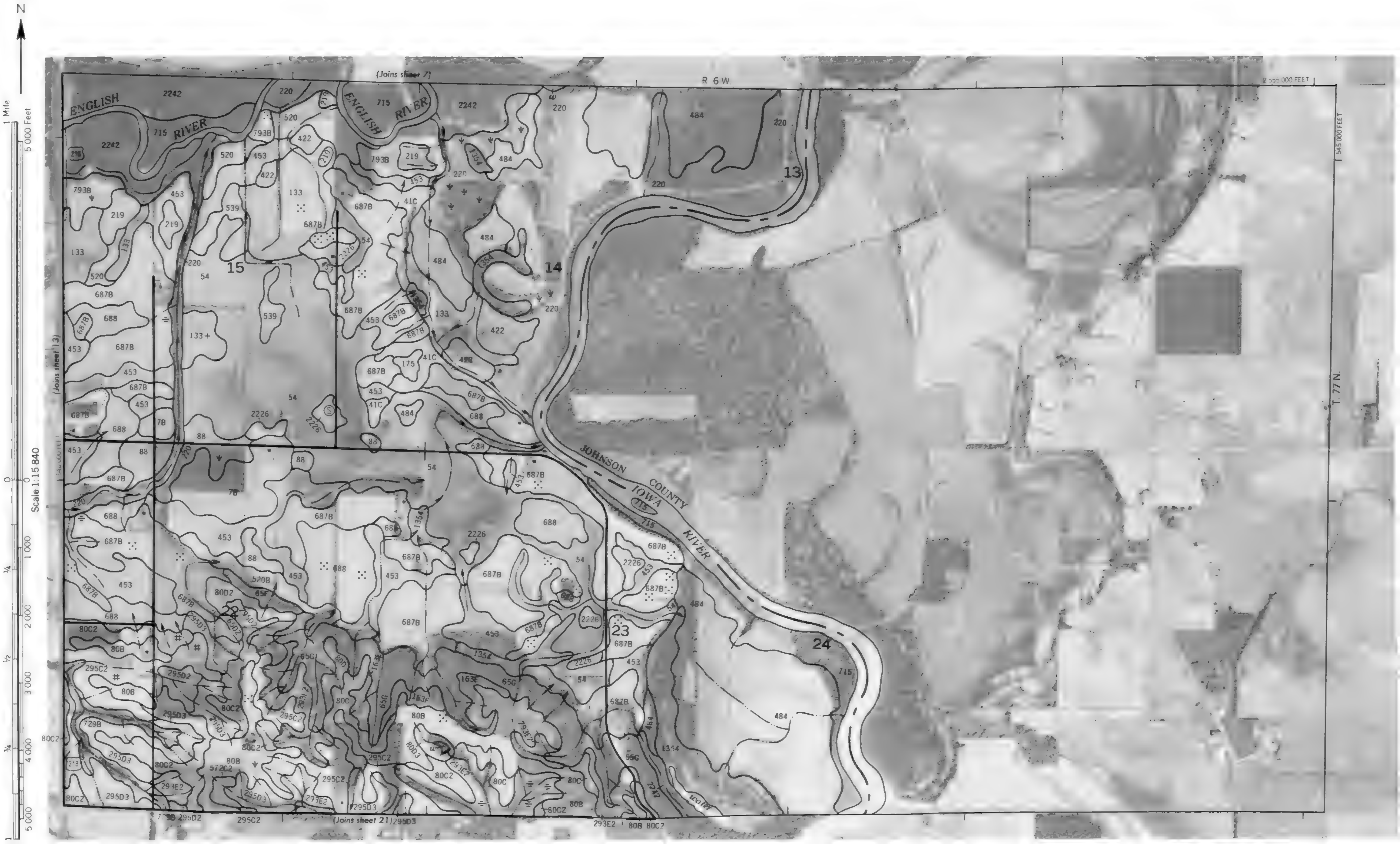

N
(Joins sheet 2)
R. 9 W.
R. 8 W.
T. 77 N.
(Joins sheet 8)
(Joins sheet 10)
(Joins sheet 16)
Wellman
Smith Creek
Smith
Creek
water
15
14
13
18
22
23
24
19
1 Mile
5 000 Feet
Scale 1:15 840
0
1000
2000
3000
4000
5000
¼
½
¾

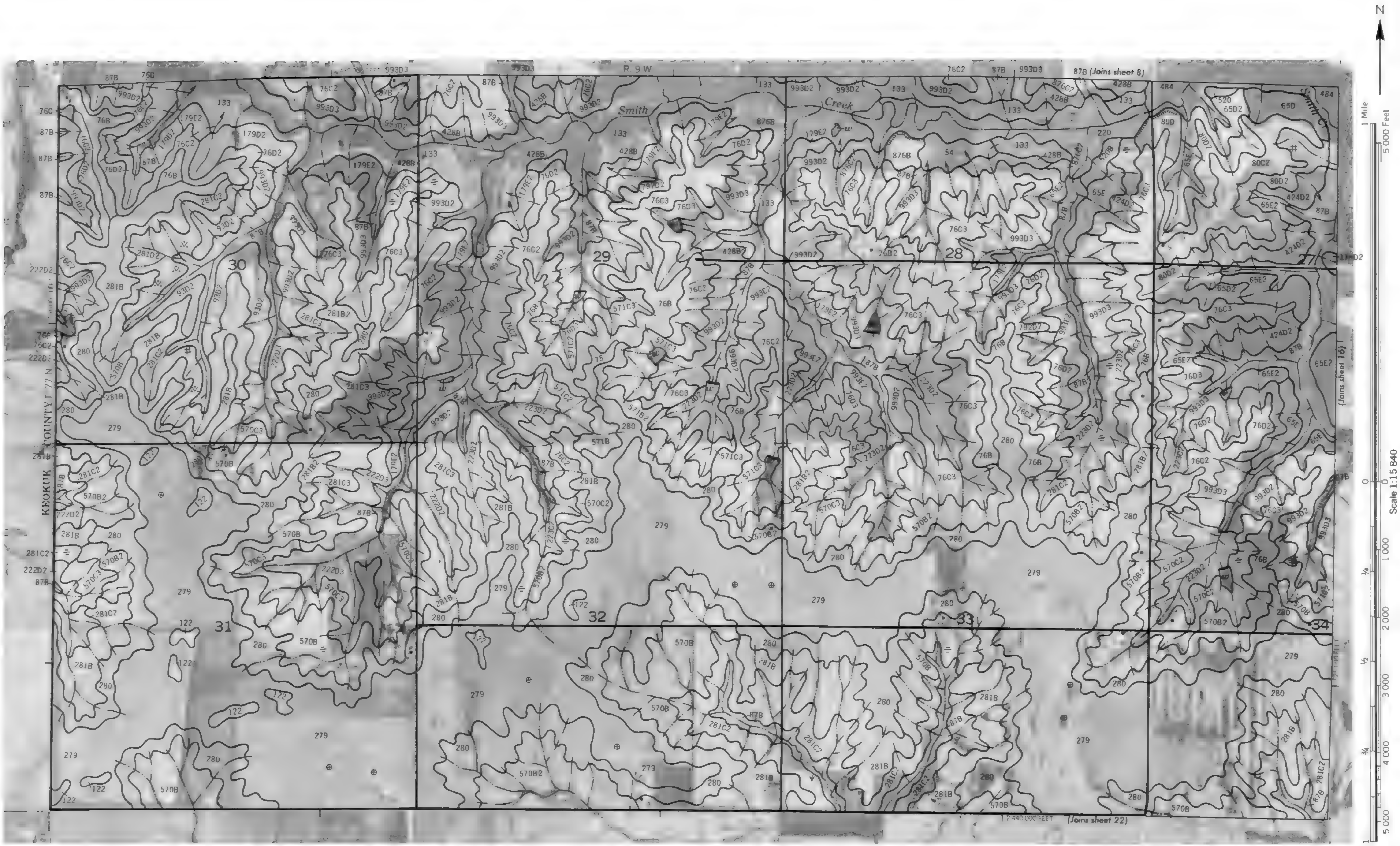

N
1 Mile
5 000 Feet
Scale 1:15 840
(Joins sheet 3)
R 8 W.
T 77 N
(Joins sheet 9)
(Joins sheet 11)
(Joins sheet 17)
ENGLISH
RIVER
Smith
Creek
Lime
Creek
14
15
16
17
20
21
22
23

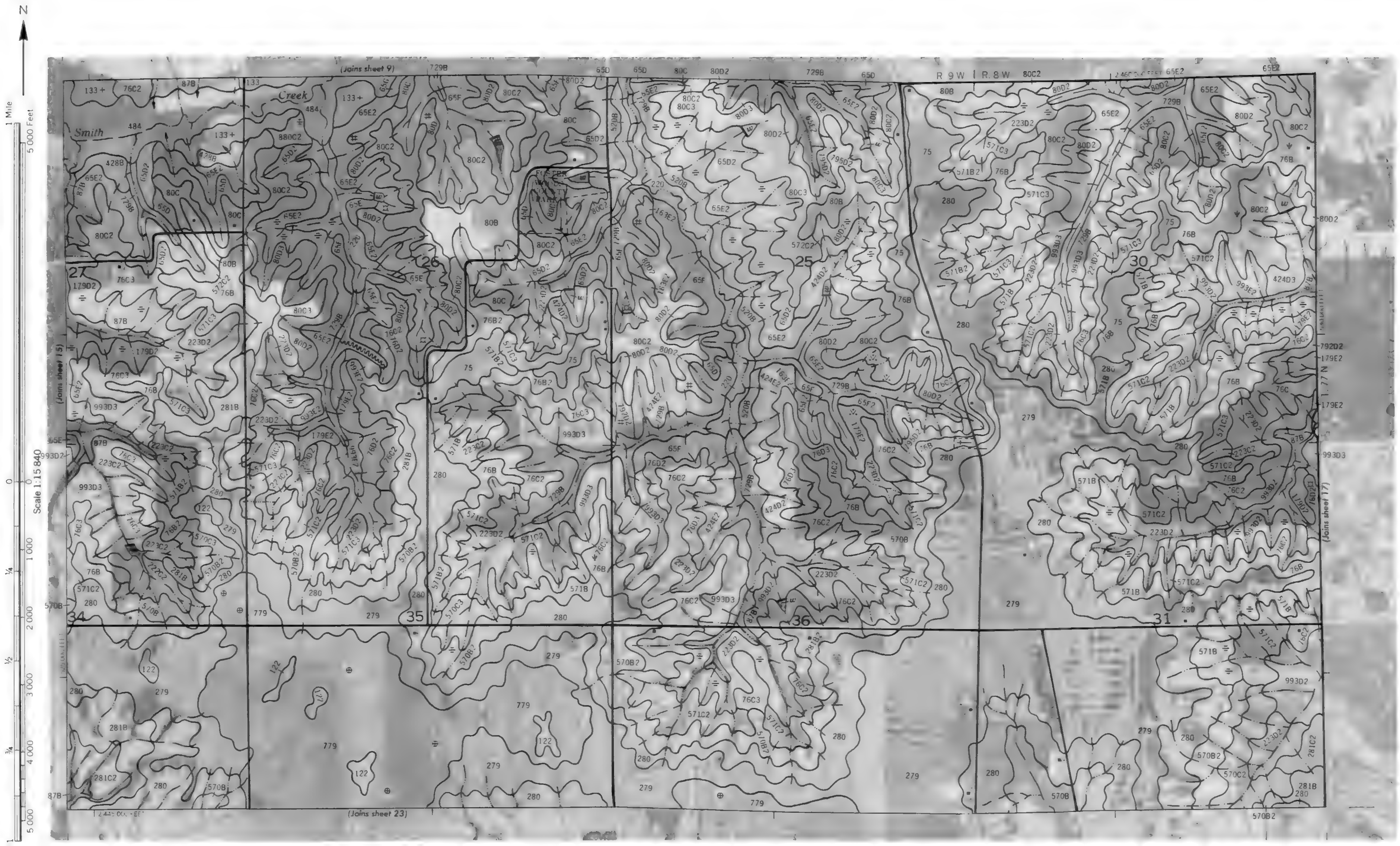

R. 8 W.
R. 7 W.
(Joins sheet 4)
(Joins sheet 10)
(Joins sheet 12)
(Joins sheet 18)
T. 77 N.
KALONA
SEWAGE
LAGOON
ENGLISH
RIVER
Ramsey
Camp
Creek
water
N
1 Mile
5 000 Feet
Scale 1:15 840

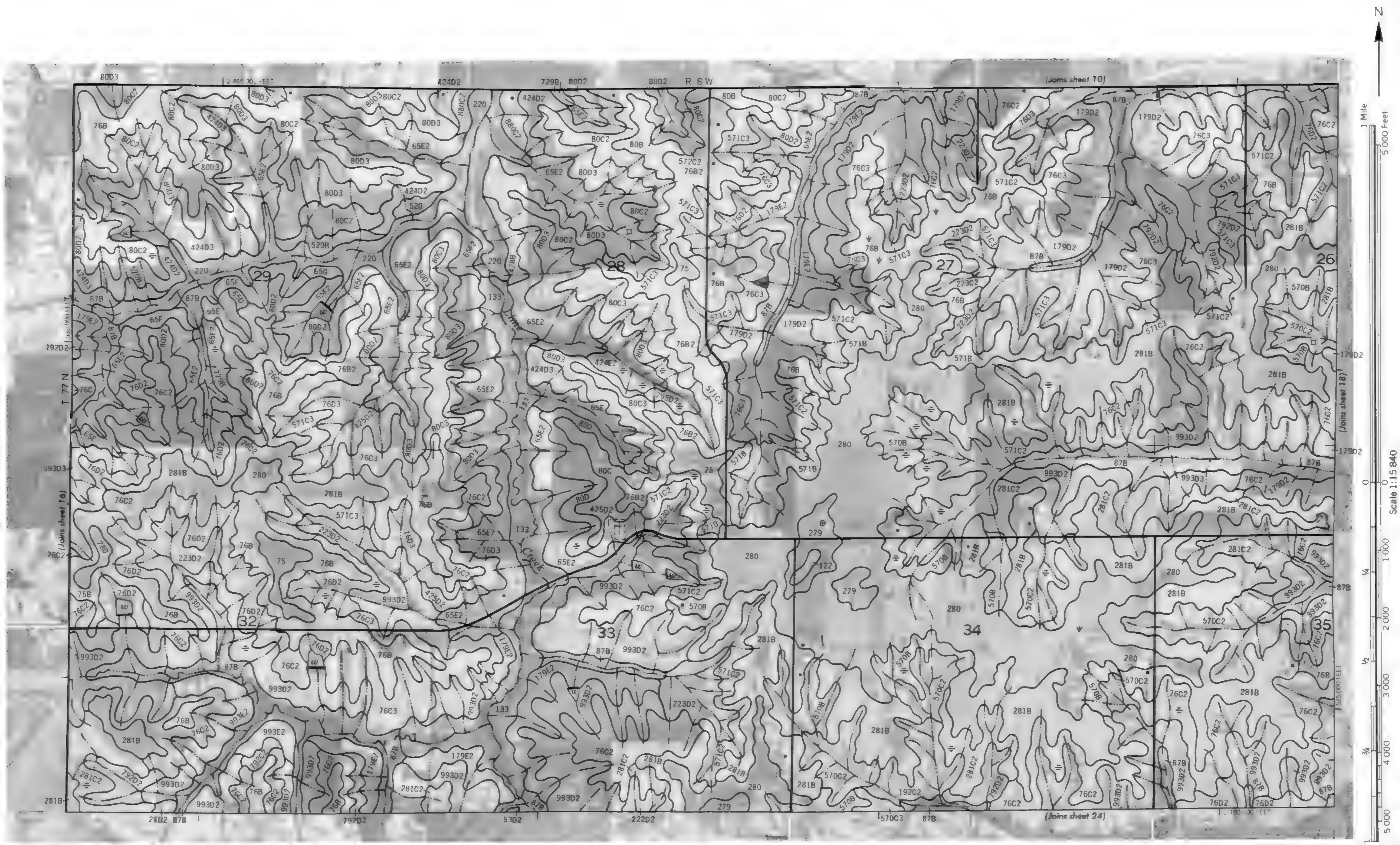

N
1 Mile
5 000 Feet
Scale 1:15 840
(Joins sheet 5)
R. 7 W.
(Joins sheet 11)
(Joins sheet 13)
(Joins sheet 19)
T. 77 N.
ENGLISH
RIVER
Bulgers Run
Lilly Pond
16
15
14
13
21
22
23
24

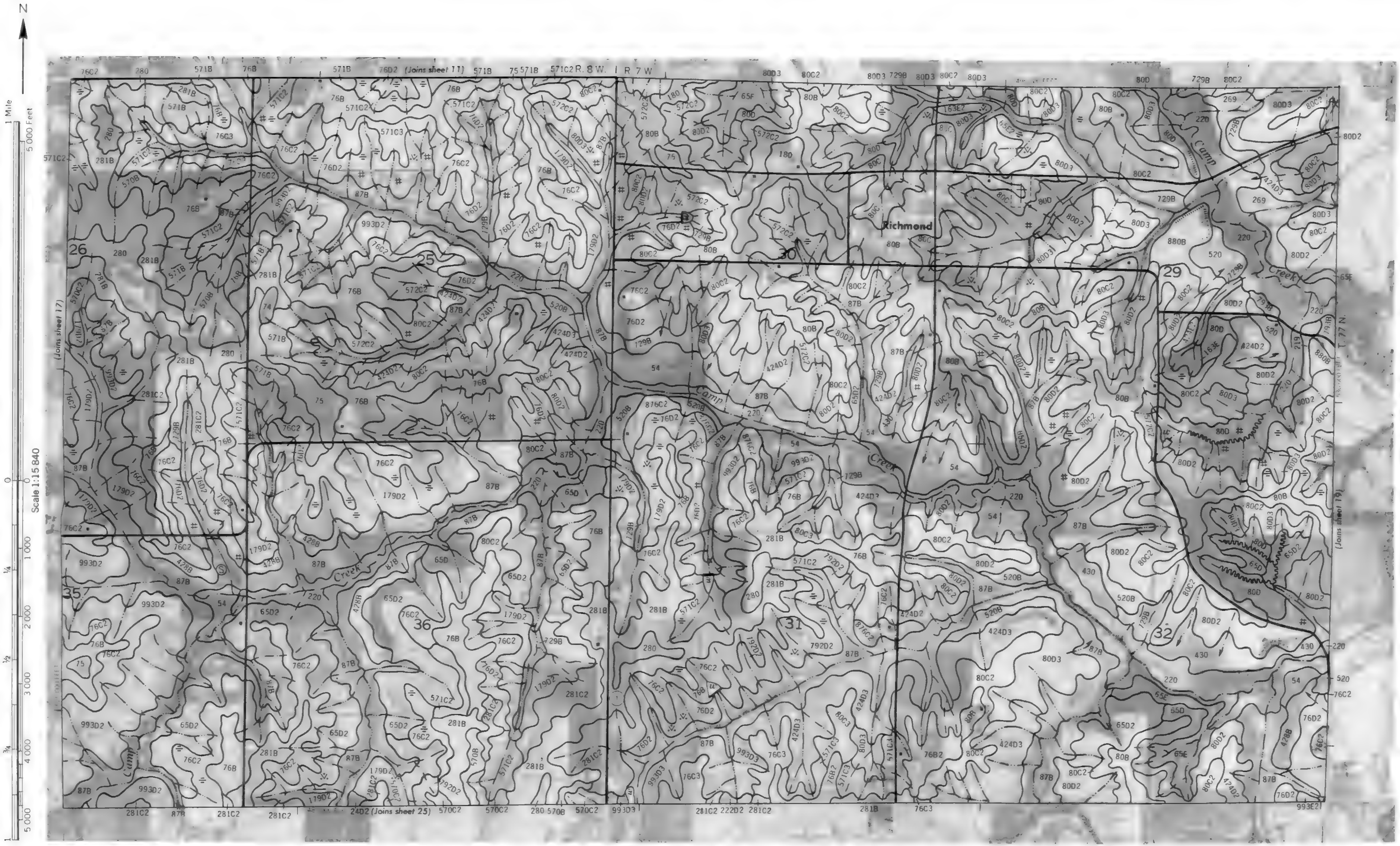

13
N
R. 7 W.
R. 6 W.
T. 77 N.
Riverside
ENGLISH
RIVER
(Joins sheet 6)
(Joins sheet 12)
(Joins sheet 14)
(Joins sheet 20)
1 Mile
5 000 Feet
Scale 1:15 840

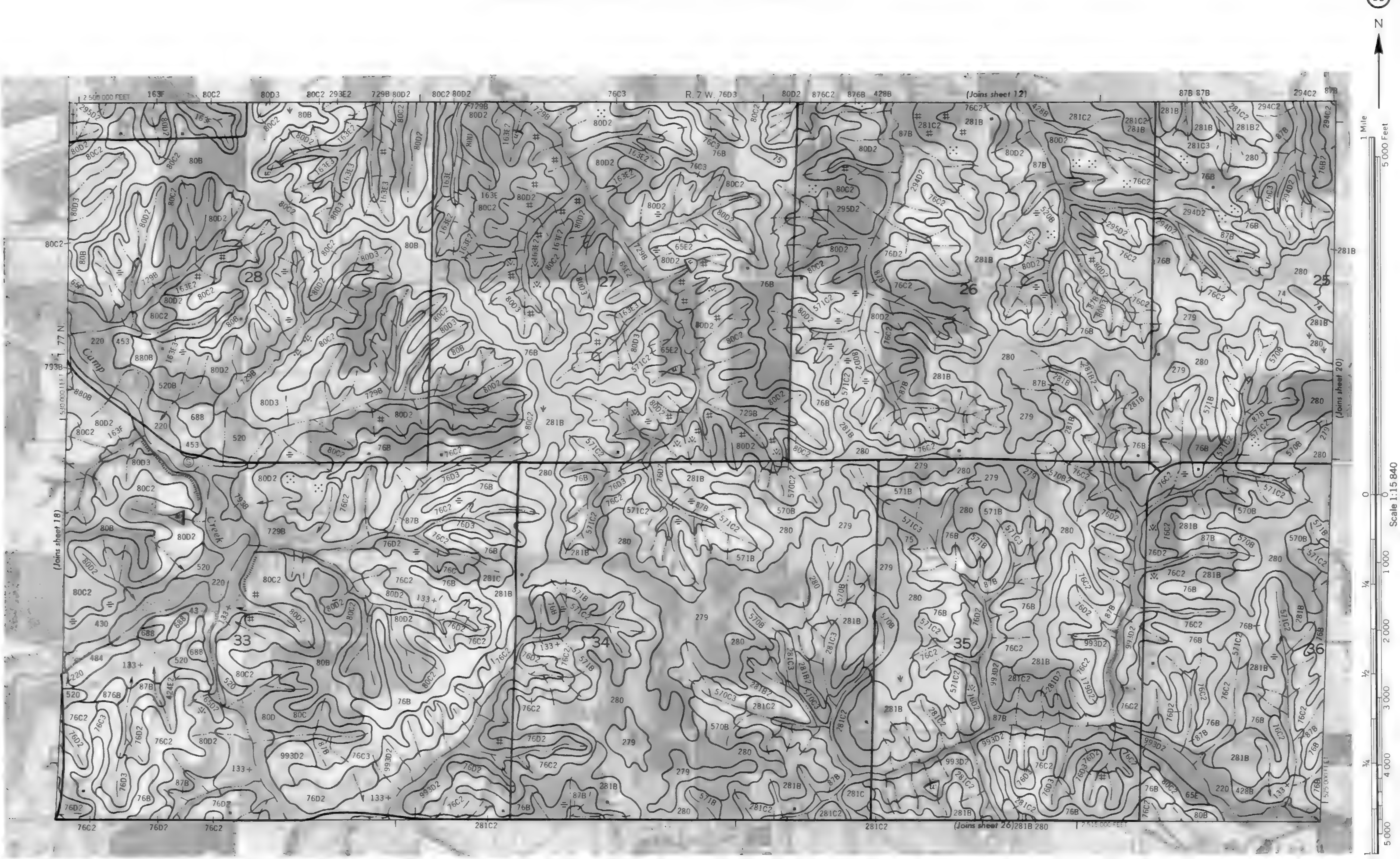

N
(Joins sheet 7)
R 6 W.
ENGLISH RIVER
ENGLISH RIVER
ENGLISH RIVER
(Joins sheet 13)
(Joins sheet 21)
JOHNSON COUNTY
IOWA RIVER
T. 77 N.
Scale 1:15 840
1 Mile
5 000 Feet
545 000 FEET
13
14
15
23
24
2242
220
715
520
793B
453
422
219
133
539
687B
484
1354
688
54
88
2226
41C
175
7B
80C2
80B
295C2
295D3
295D2
729B
65G
163E
163F
80C
80D3
293E2
572C2
65F
570B

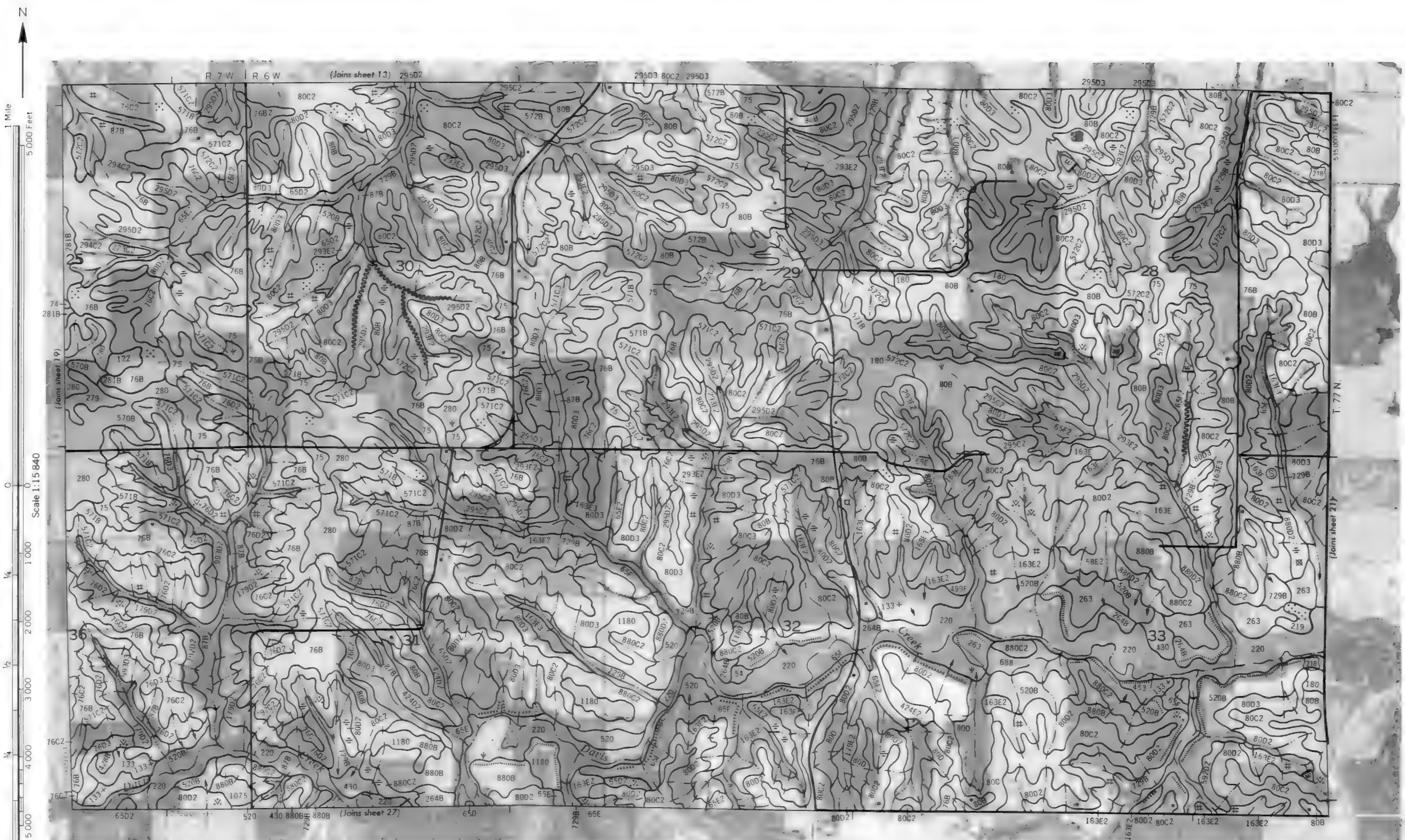

N
R. 9 W
87B (Joins sheet 8)
Smith
Creek
(Joins sheet 16)
(Joins sheet 22)
KEOKUK COUNTY
T 77 N
30
29
28
27
31
32
33
34
1 Mile
5 000 Feet
Scale 1:15 840
1 000
2 000
3 000
4 000
5 000
0
¼
½
¾


N
(Joins sheet 9)
(Joins sheet 23)
(Joins sheet 15)
(Joins sheet 17)
R. 9 W. | R. 8 W.
T. 77 N.
Scale 1:15 840
1 Mile
5 000 Feet
Smith
Creek

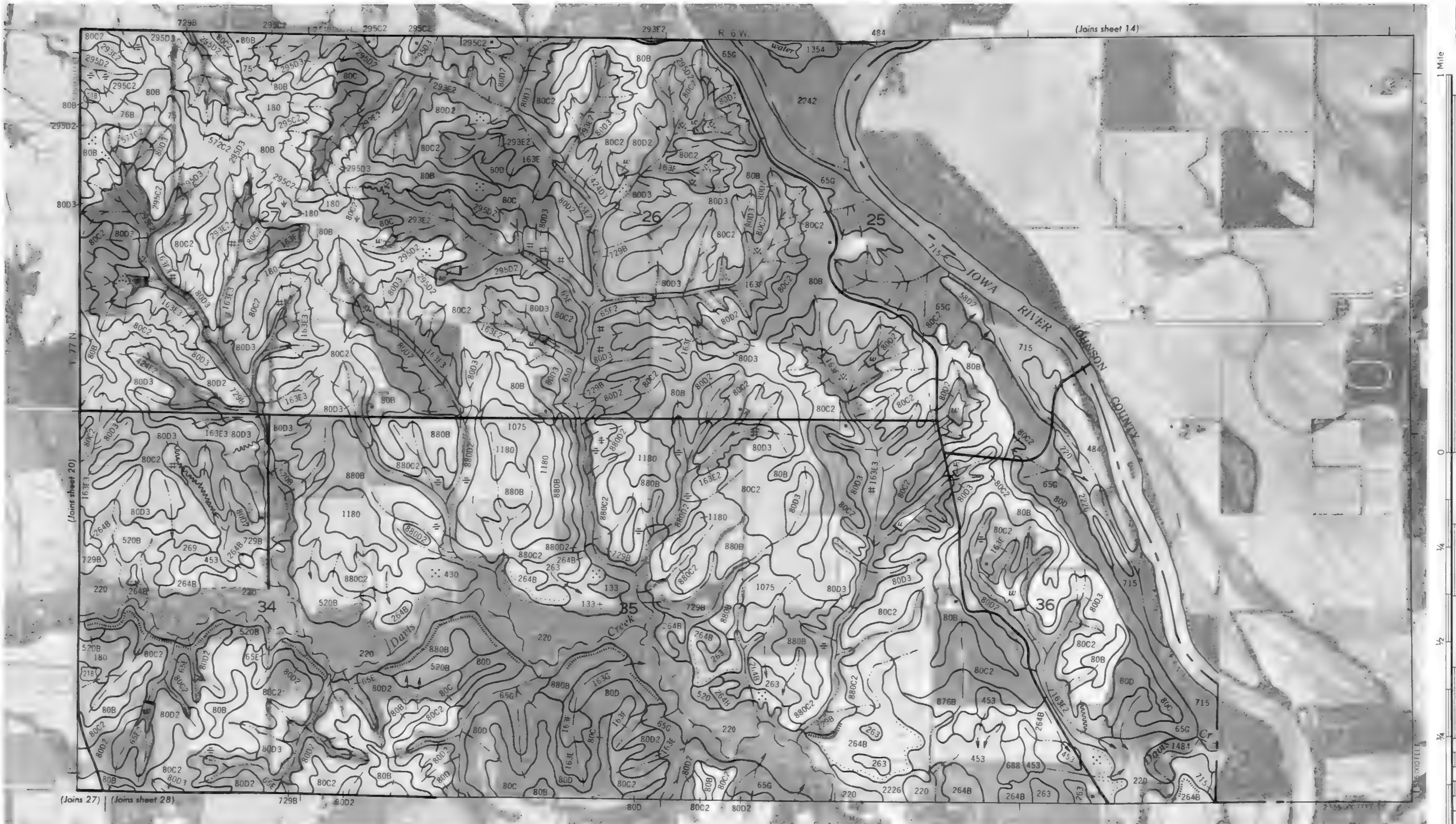

N
(Joins sheet 10)
(Joins sheet 16)
(Joins sheet 18)
(Joins sheet 24)
R 8 W
T 77 N
29
28
27
26
32
33
34
35
Creek
1 Mile
5 000 Feet
Scale 1:15 840


N
1 Mile
5 000 Feet
Scale 1:15 840
(Joins sheet 11)
(Joins sheet 17)
(Joins sheet 19)
(Joins sheet 25)
R. 8 W.
R. 7 W.
T. 77 N.
Richmond
Camp Creek
26
25
30
29
35
36
31
32

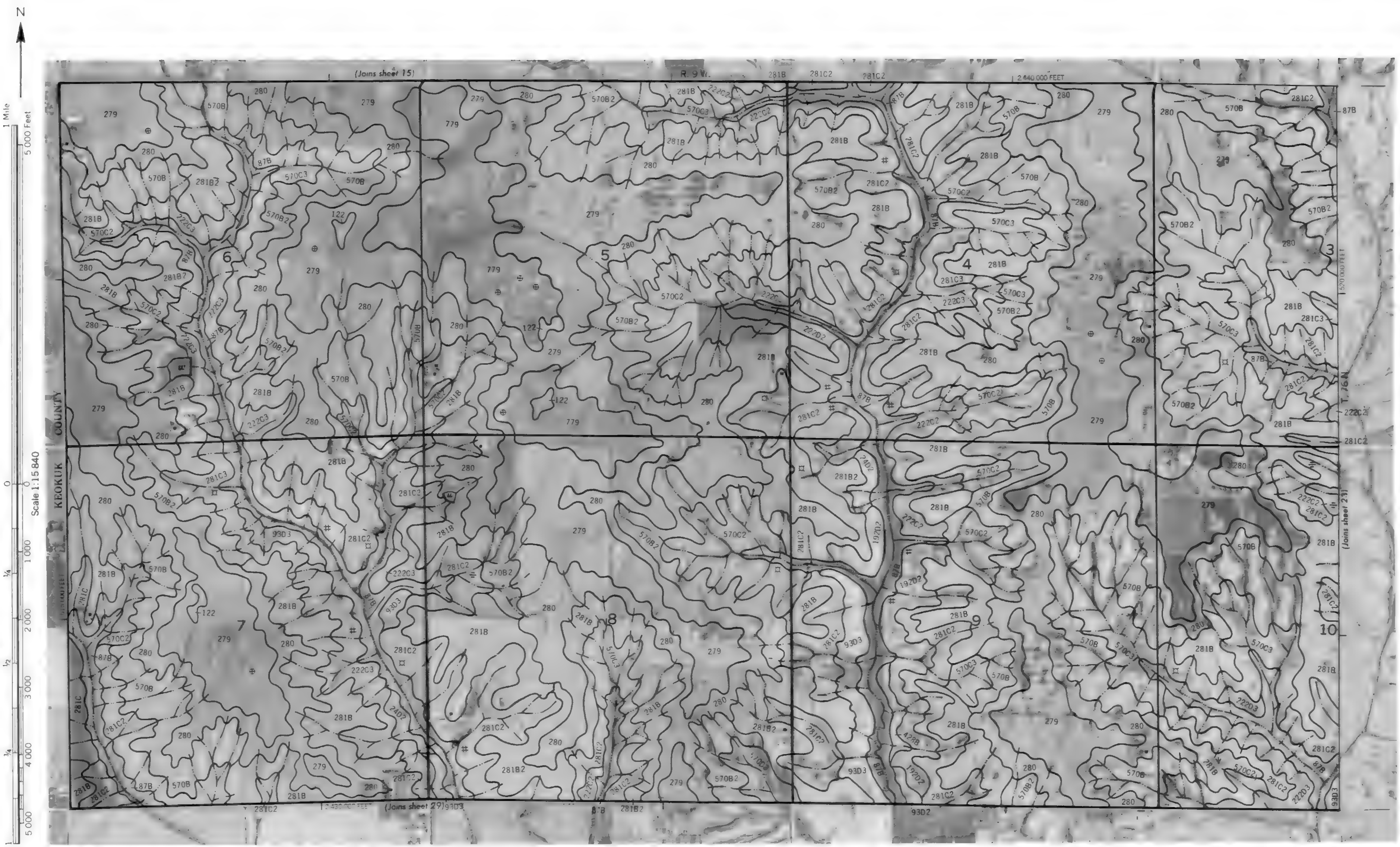

19
N
(Joins sheet 12)
R. 7 W.
T. 77 N.
(Joins sheet 20)
(Joins sheet 18)
(Joins sheet 26)
Camp
Creek
28
27
26
25
33
34
35
36
1 Mile
5 000 Feet
Scale 1:15 840
0
1/4
1/2
3/4
1 000
2 000
3 000
4 000
5 000

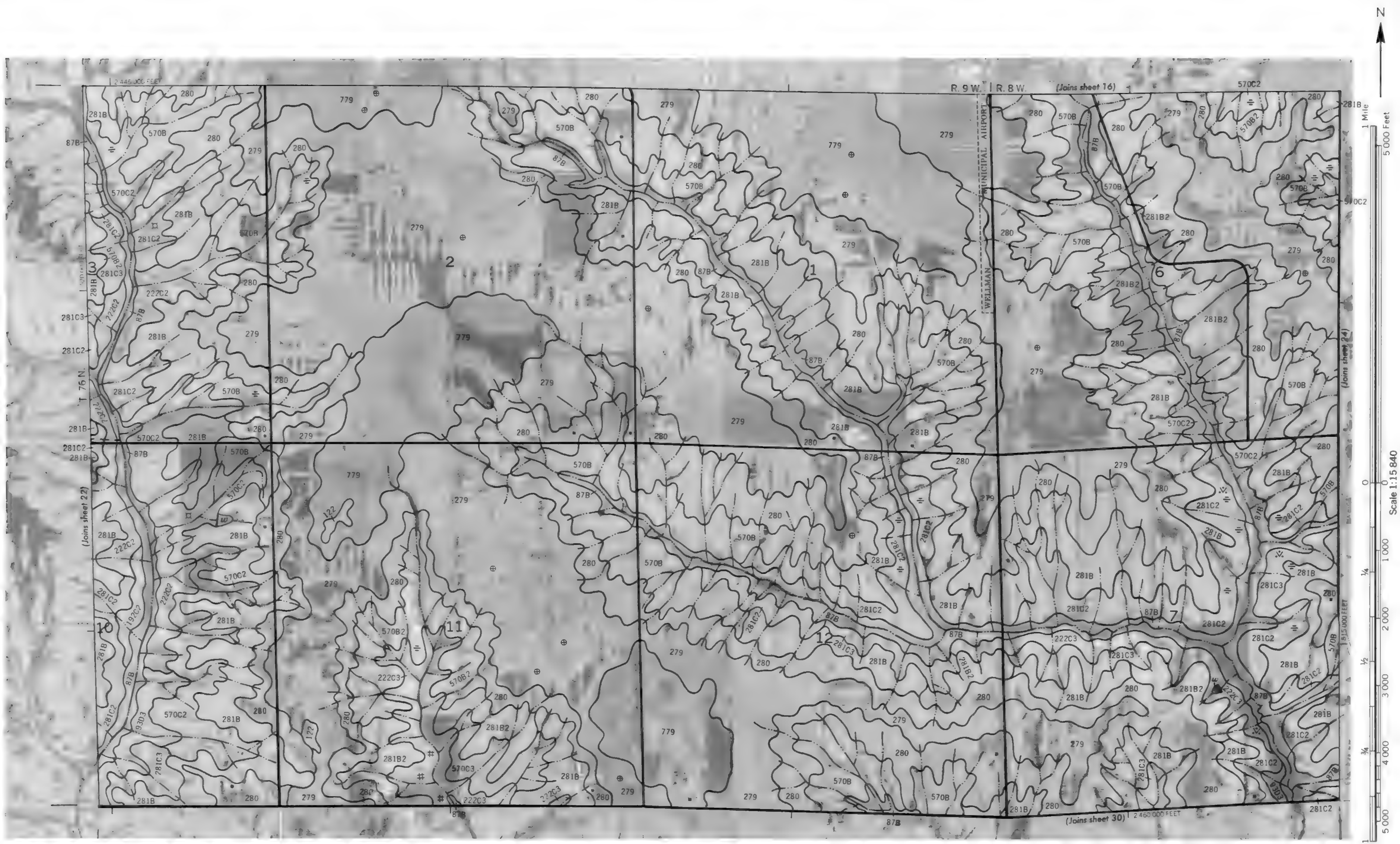

N
1 Mile
5 000 Feet
Scale 1:15 840
R. 7 W.
R. 6 W.
(Joins sheet 13)
(Joins sheet 19)
(Joins sheet 21)
(Joins sheet 27)
T. 77 N.
Davis Creek
25
30
29
28
36
31
32
33

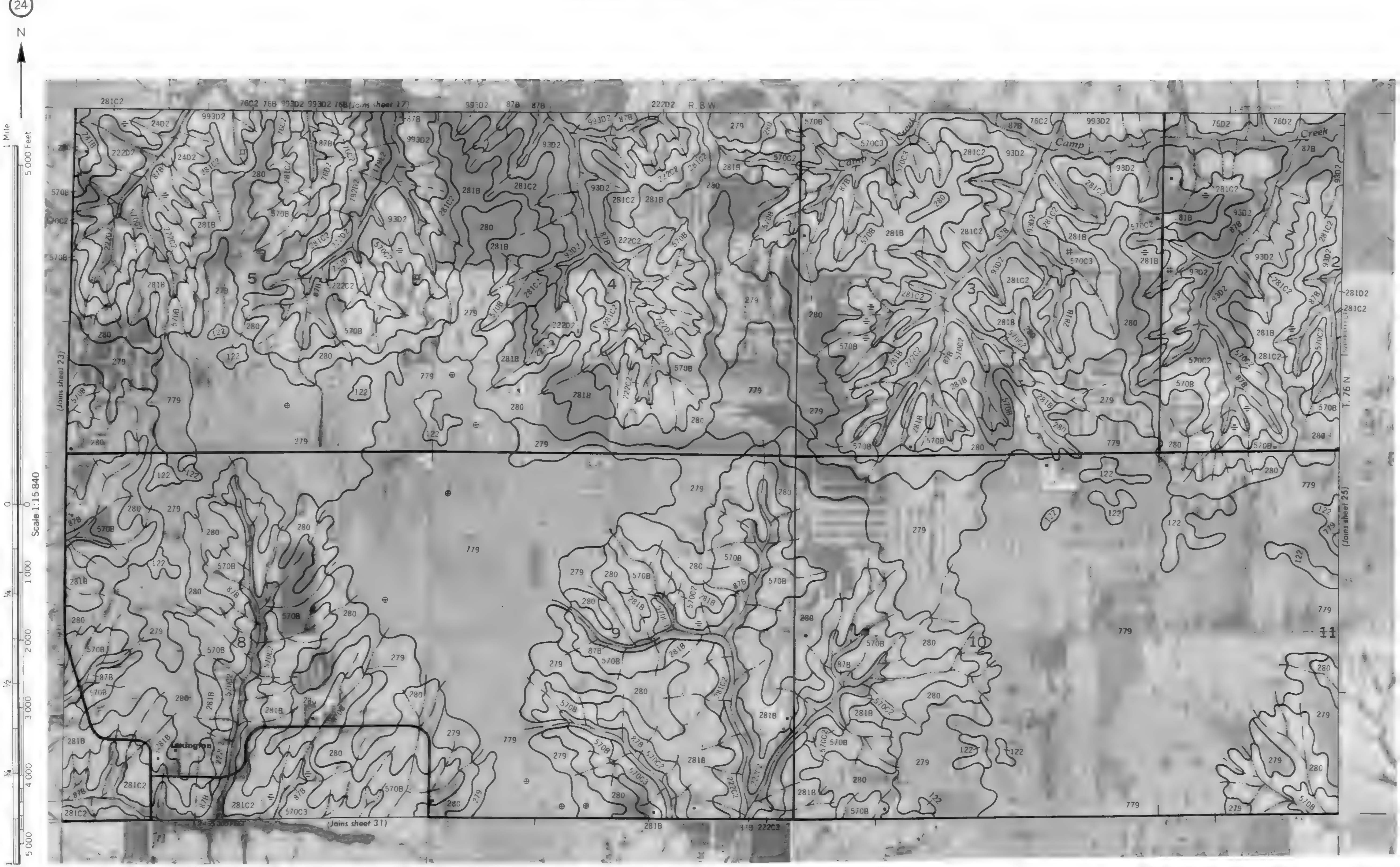
21



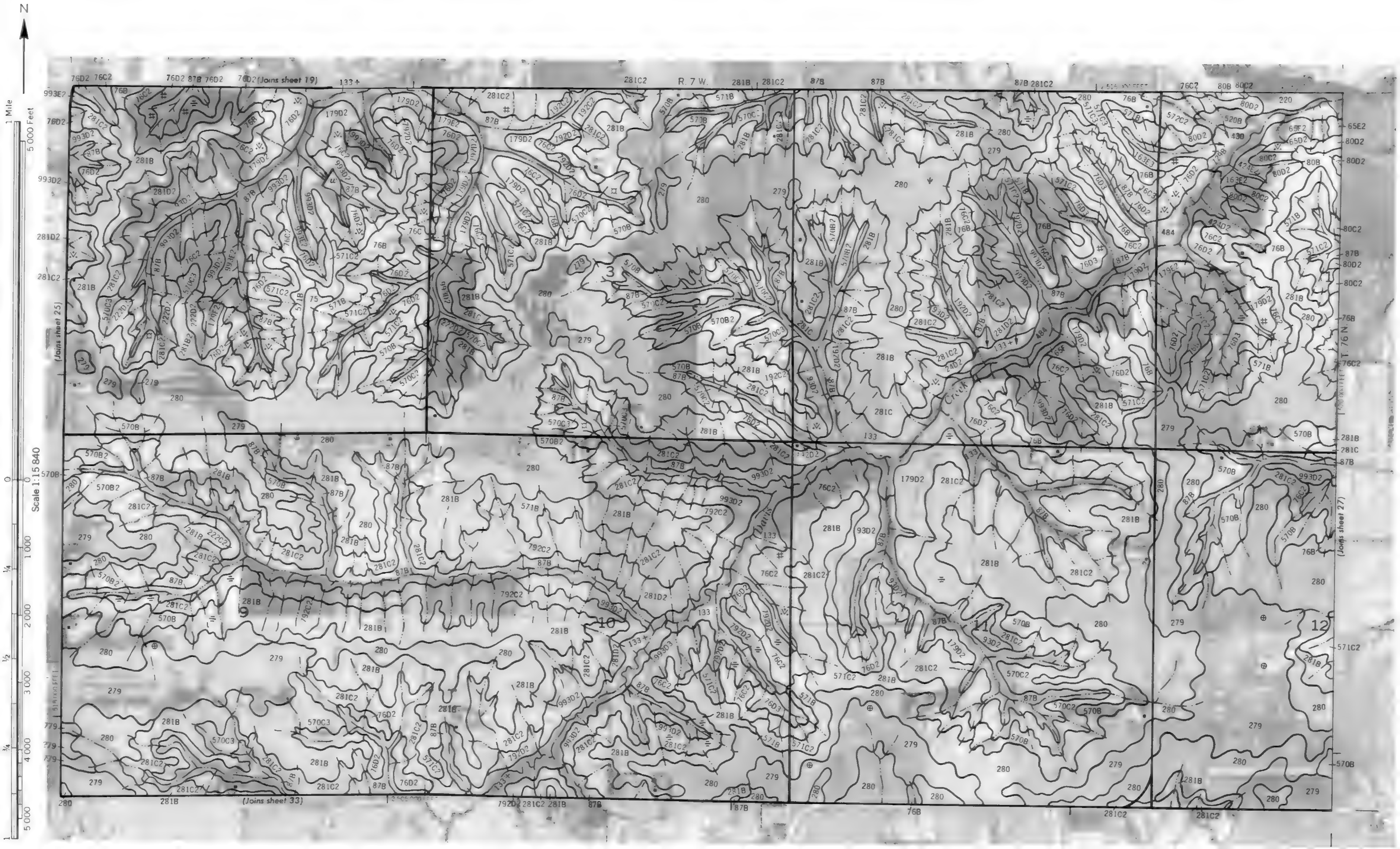
(Joins sheet 14)
R 6 W.
T. 77 N.
(Joins sheet 20)
(Joins 27)
(Joins sheet 28)
IOWA RIVER
JOHNSON COUNTY
Davis Creek
Davis Cr.
water
26
25
27
34
35
36
N
1 Mile
5 000 Feet
Scale 1:15 840

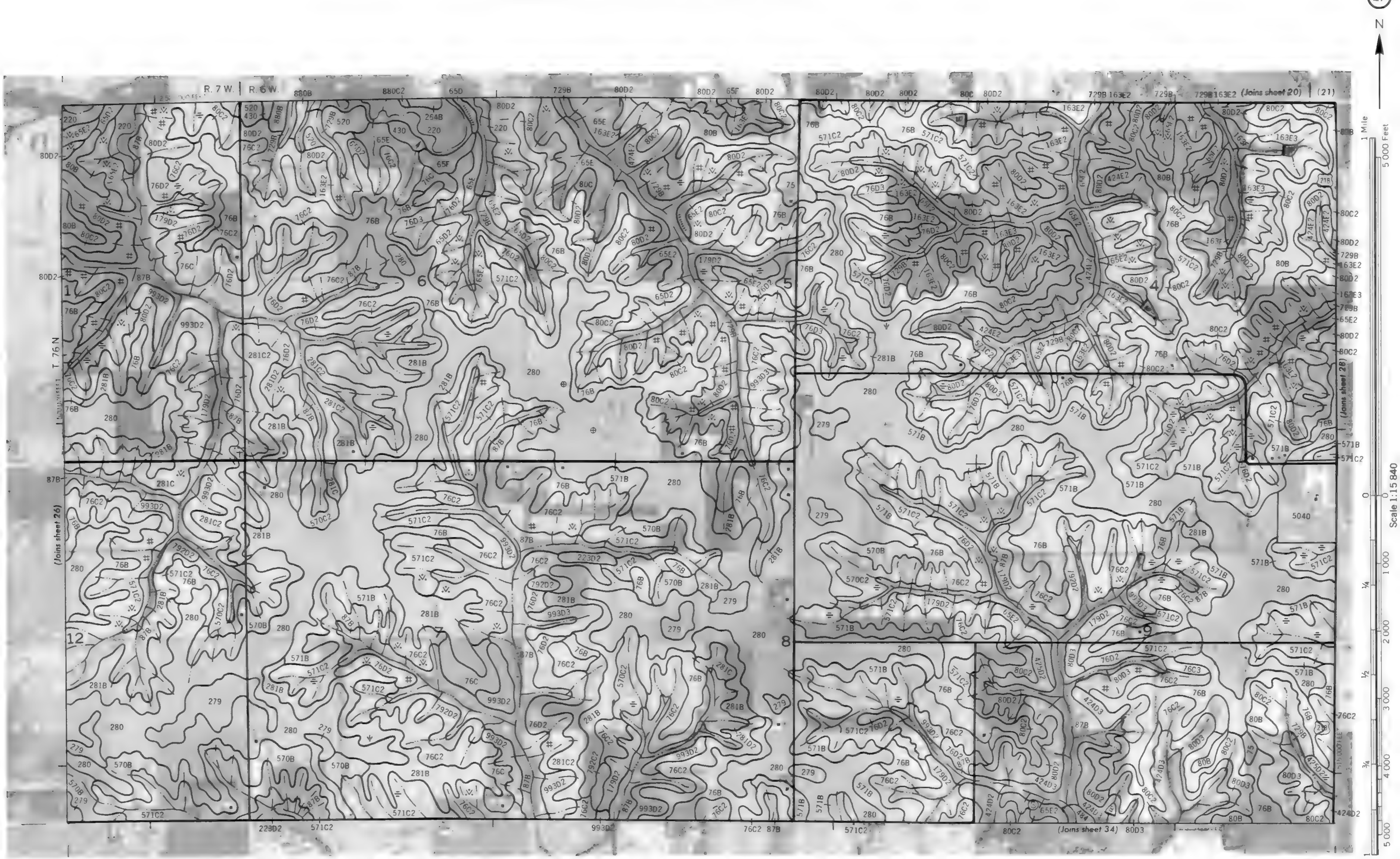

N
(Joins sheet 15)
R. 9 W.
2 440 000 FEET
520 000 FEET
T. 76 N.
(Joins sheet 23)
(Joins sheet 29)
2 430 000 FEET
KEOKUK COUNTY
Scale 1:15 840
1 Mile
5 000 Feet
0
1 000
2 000
3 000
4 000
5 000
¼
½
¾
0
3
4
5
6
7
8
9
10

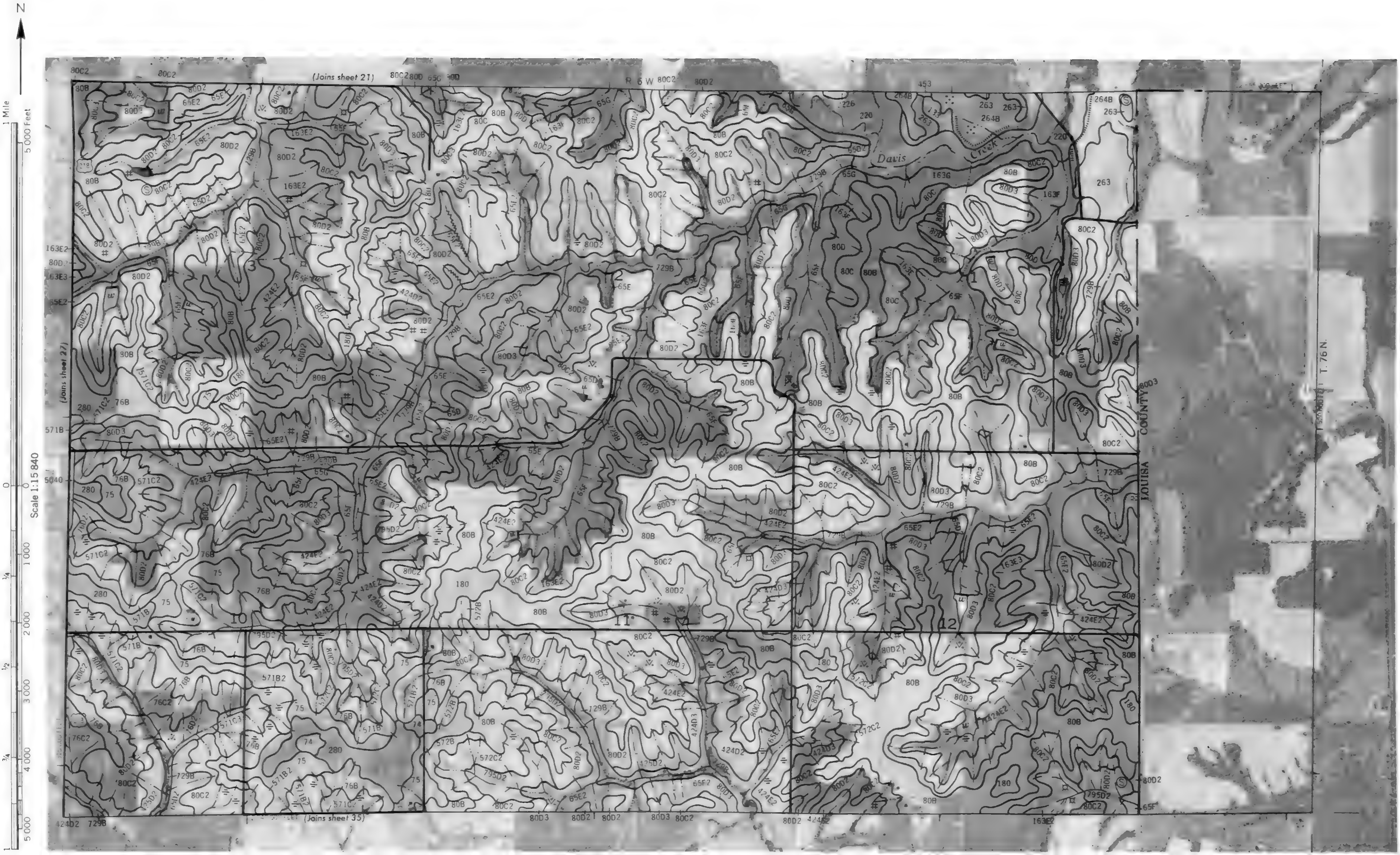

N
R. 9 W.
R. 8 W.
(Joins sheet 16)
MUNICIPAL AIRPORT
WELLMAN
(Joins sheet 24)
(Joins sheet 22)
(Joins sheet 30)
T. 76 N.
2 446 000 FEET
2 460 000 FEET
1 Mile
5 000 Feet
Scale 1:15 840

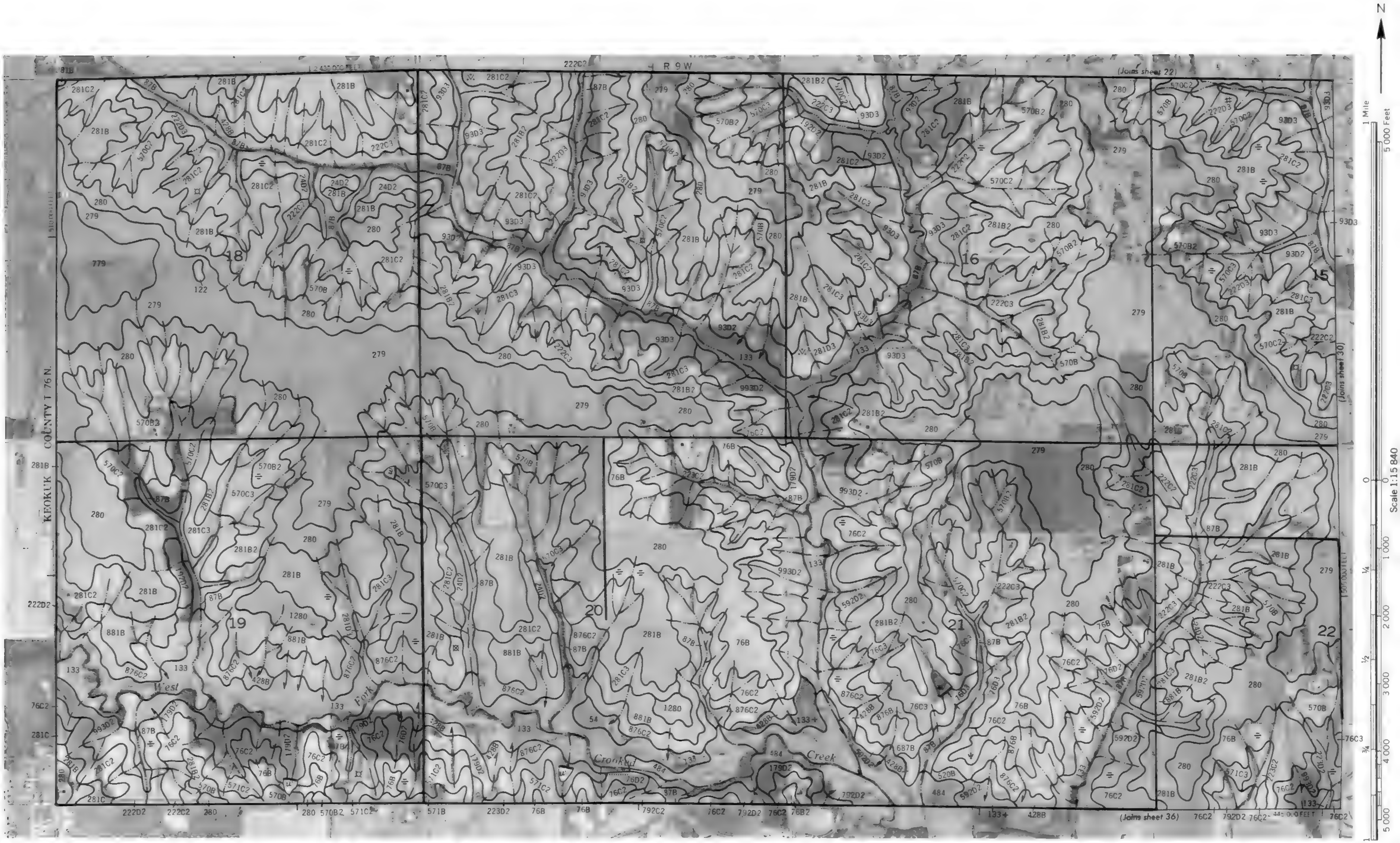

N
1 Mile
5 000 Feet
Scale 1:15 840
(Joins sheet 17)
(Joins sheet 23)
(Joins sheet 25)
(Joins sheet 31)
R. 8 W.
T. 76 N.
Camp Creek
Lexington

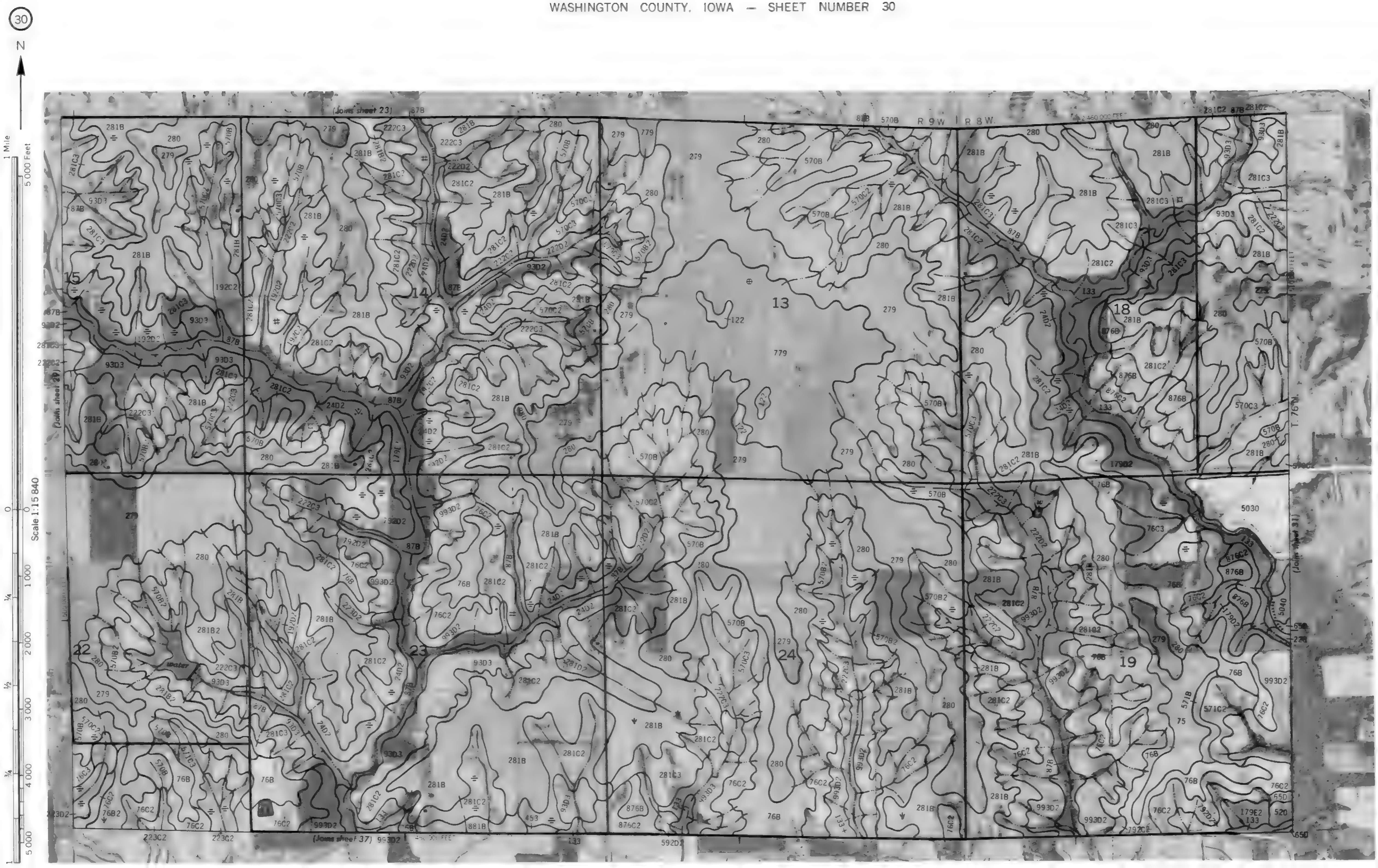

25
N
R. 8 W.
R. 7 W.
T. 76 N.
(Joins sheet 18)
(Joins sheet 26)
(Joins sheet 24)
570C2 (Joins sheet 32)
1
2
5
6
7
8
11
12
1 Mile
5 000 Feet
Scale 1:15 840
0
1 000
2 000
3 000
4 000
5 000
1/4
1/2
3/4

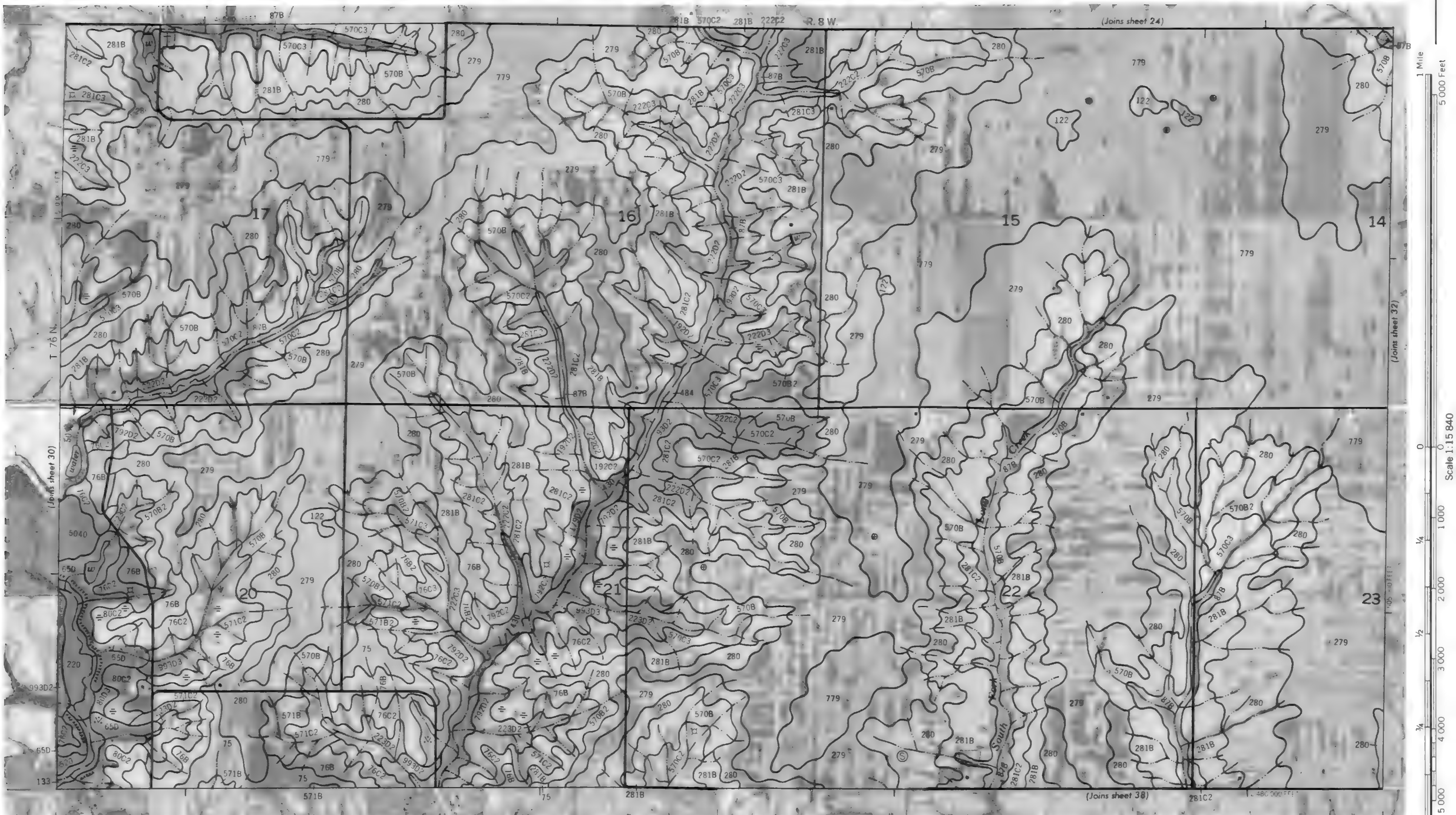

N
1 Mile
5 000 Feet
Scale 1:15 840
(Joins sheet 19)
(Joins sheet 25)
(Joins sheet 27)
(Joins sheet 33)
R. 7 W.
T. 76 N.
Davis
Creek
3
4
9
10
11
12


27
N
R. 7 W.
R. 6 W.
T. 76 N.
(Joins sheet 20)
(21)
(Joins sheet 26)
(Joins sheet 28)
(Joins sheet 34)
1 Mile
5 000 Feet
Scale 1:15 840
0
1/4
1/2
3/4
1 000
2 000
3 000
4 000
5 000

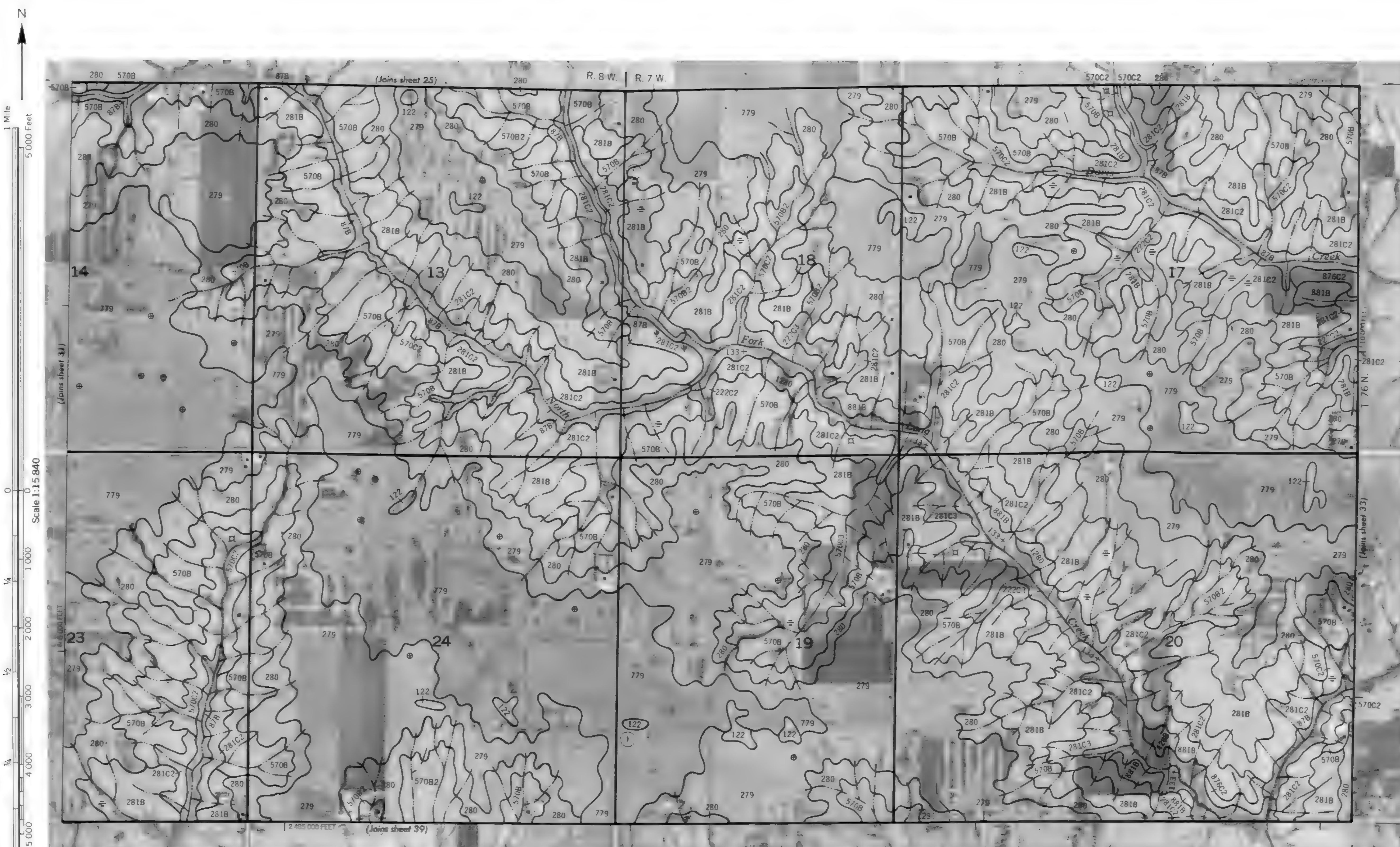

N
1 Mile
5 000 Feet
Scale 1:15 840
(Joins sheet 21)
(Joins sheet 27)
(Joins sheet 35)
R 6 W
T. 76 N.
Davis Creek
LOUISA COUNTY

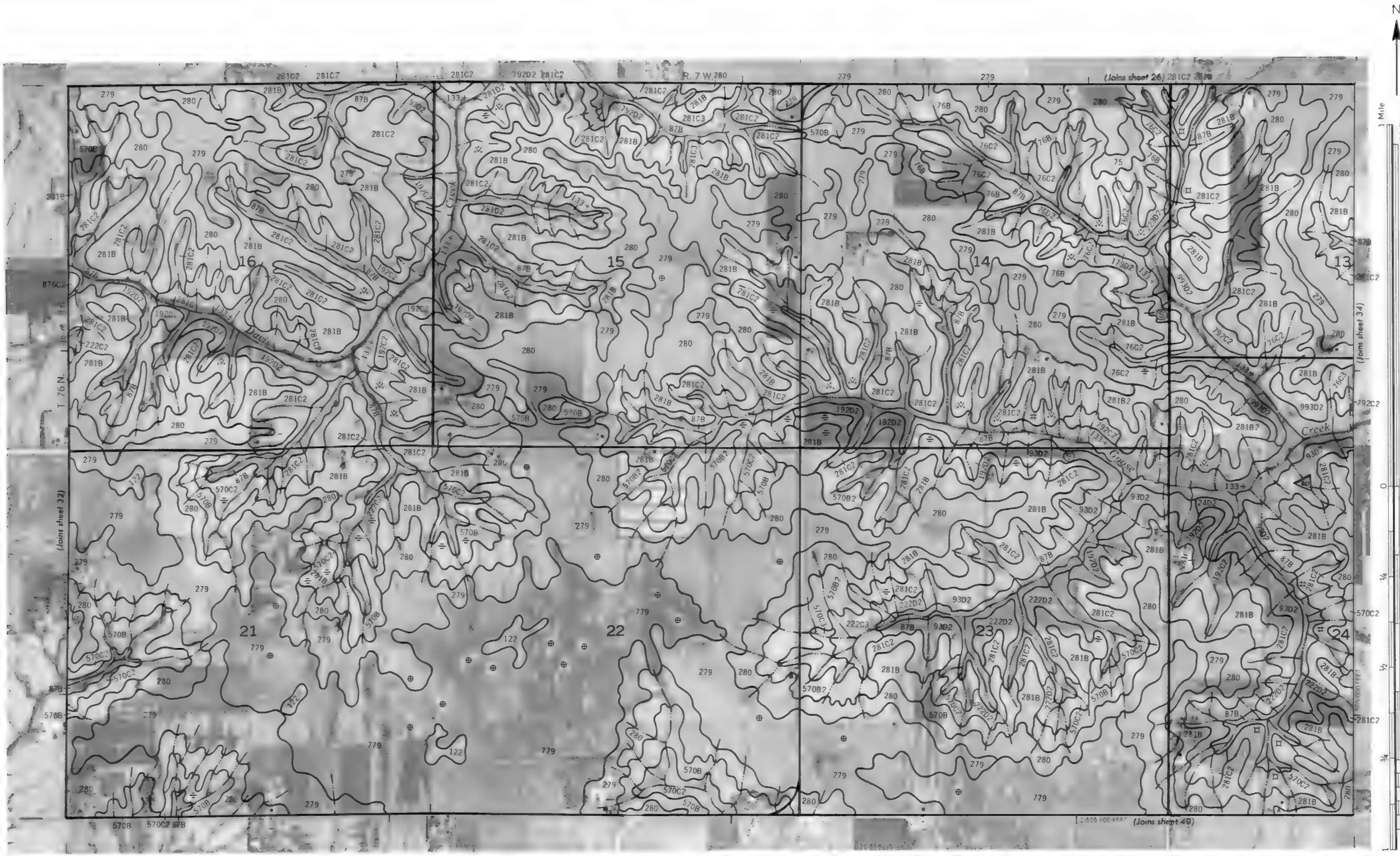

N
R 9 W
(Joins sheet 22)
(Joins sheet 30)
(Joins sheet 36)
KEOKUK COUNTY T 76 N.
18
17
16
15
19
20
21
22
West Fork
Crooked Creek
1 Mile
5 000 Feet
Scale 1:15 840
0
1 000
2 000
3 000
4 000
5 000
¼
½
¾
279
280
281B
281C2
570B2
93D3
133
87B

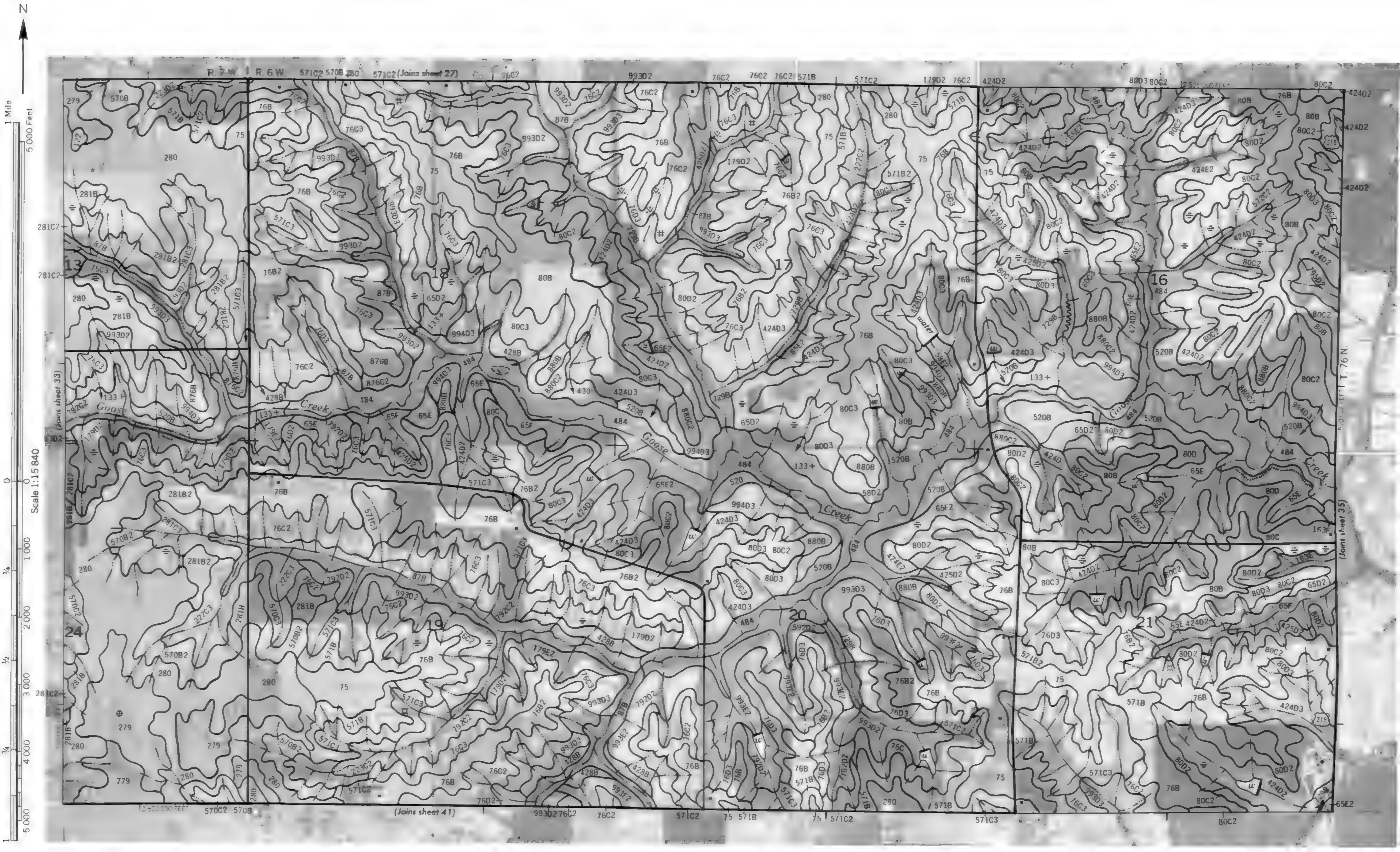

30
N
1 Mile
5 000 Feet
Scale 1:15 840
(Joins sheet 23)
(Joins sheet 29)
(Joins sheet 31)
(Joins sheet 37)
R 9 W
R 8 W
T. 76 N.
13
14
15
18
19
22
23
24
Water


31
N
R. 8 W.
(Joins sheet 24)
(Joins sheet 32)
(Joins sheet 38)
(Joins sheet 30)
T 76 N.
1 Mile
5 000 Feet
Scale 1:15 840
17
16
15
14
20
21
22
23

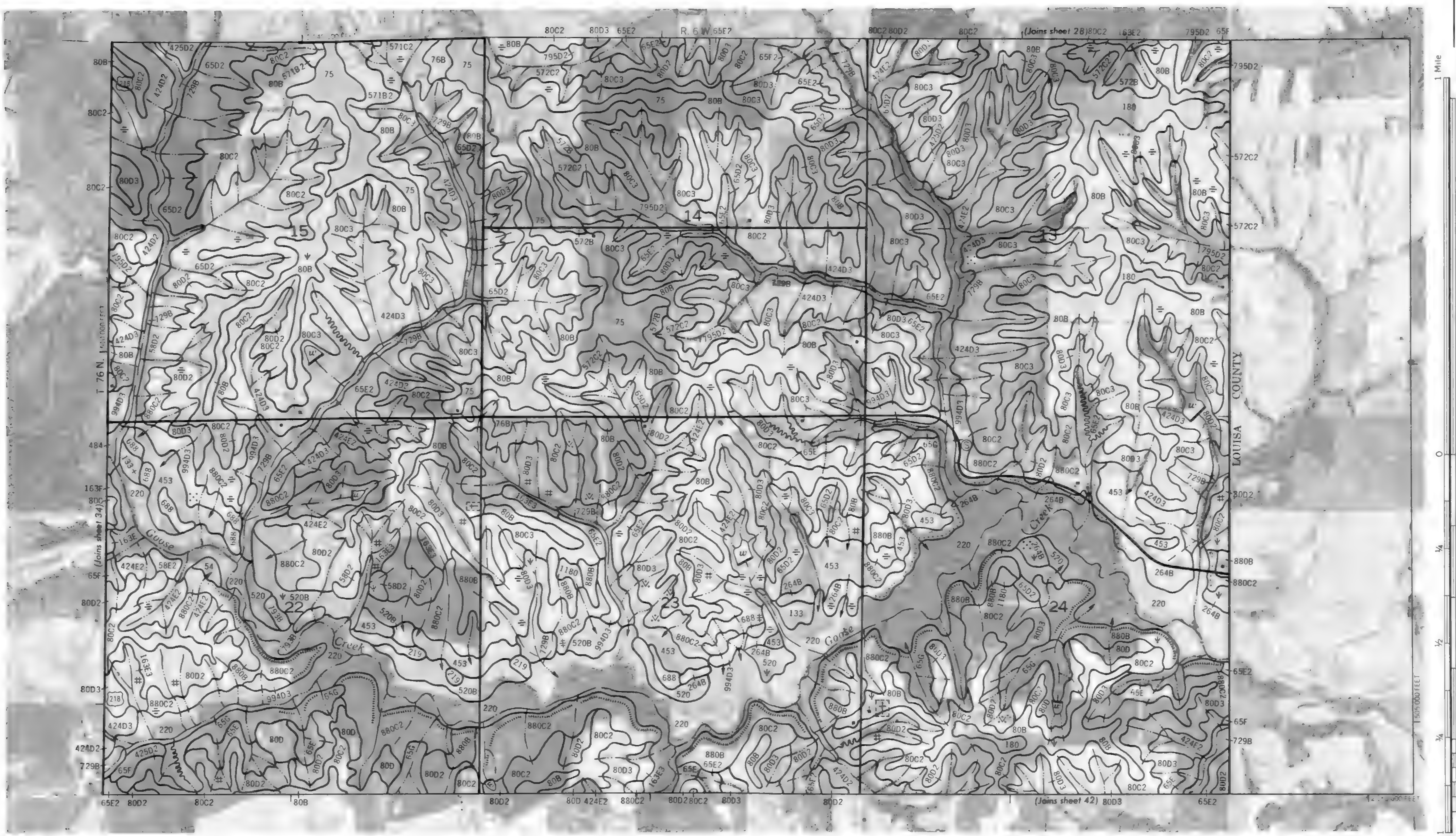
32

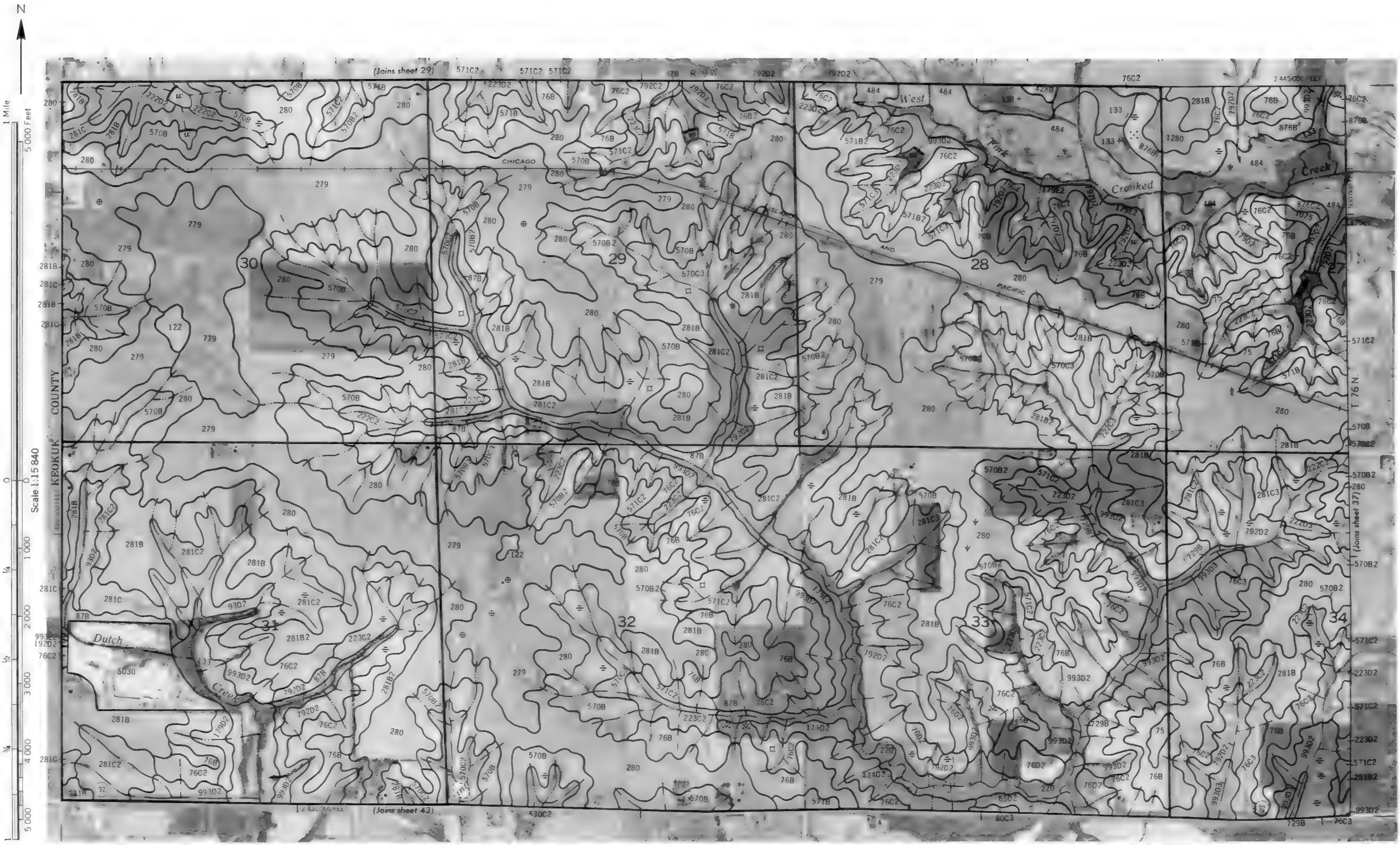

N
1 Mile
5 000 Feet
Scale 1:15 840
(Joins sheet 25)
R. 8 W.
R. 7 W.
(Joins sheet 31)
(Joins sheet 33)
(Joins sheet 39)
T. 76 N.
14
13
18
17
23
24
19
20
North Fork
Long Creek
Davis Creek
2 485 000 FEET

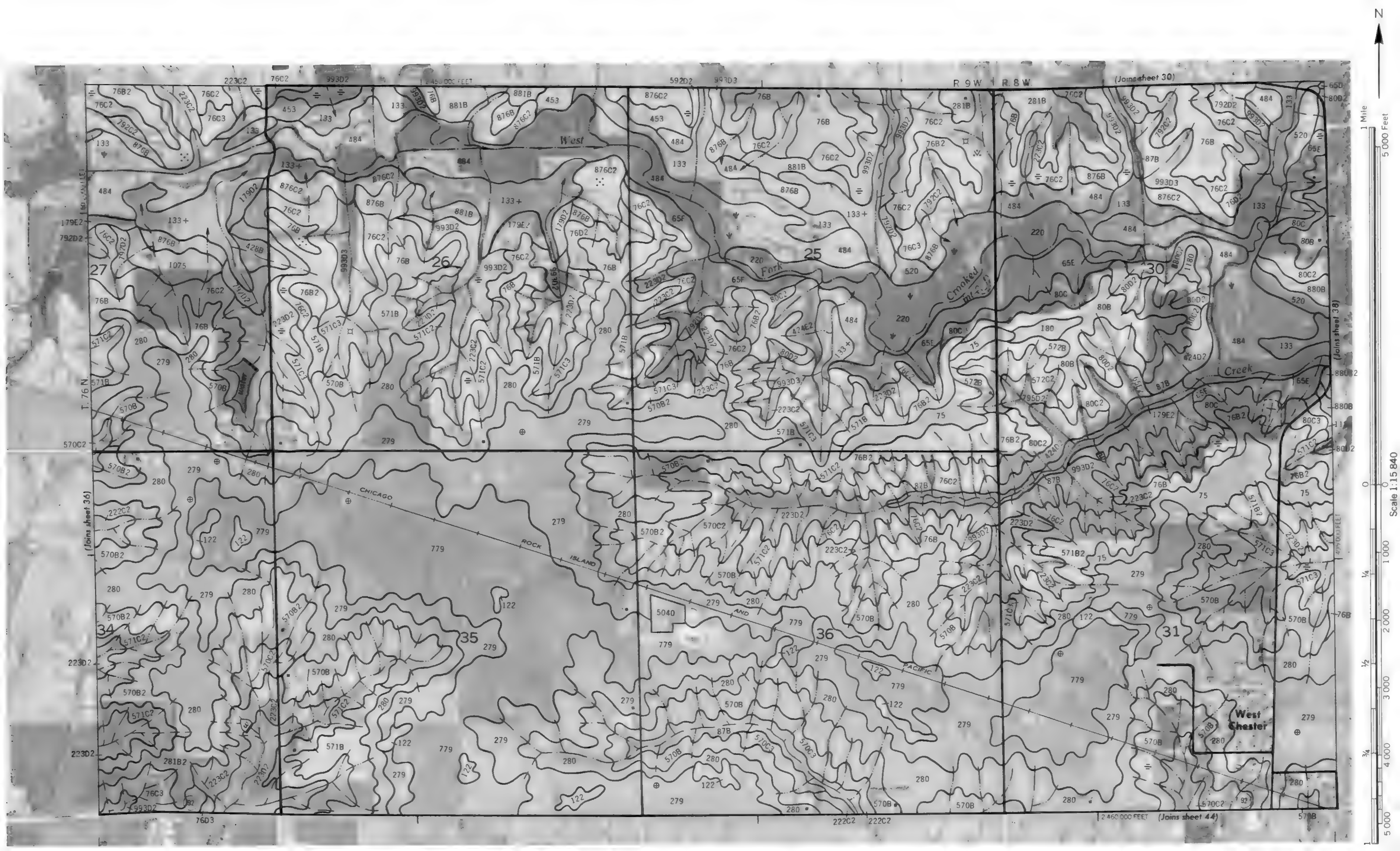

N
R. 7 W.
T. 76 N.
(Joins sheet 26)
(Joins sheet 34)
(Joins sheet 32)
(Joins sheet 40)
16
15
14
13
21
22
23
24
Davis
Creek
Goose
Creek
1 Mile
5 000 Feet
Scale 1:15 840
0
1/4
1/2
3/4
1 000
2 000
3 000
4 000
5 000

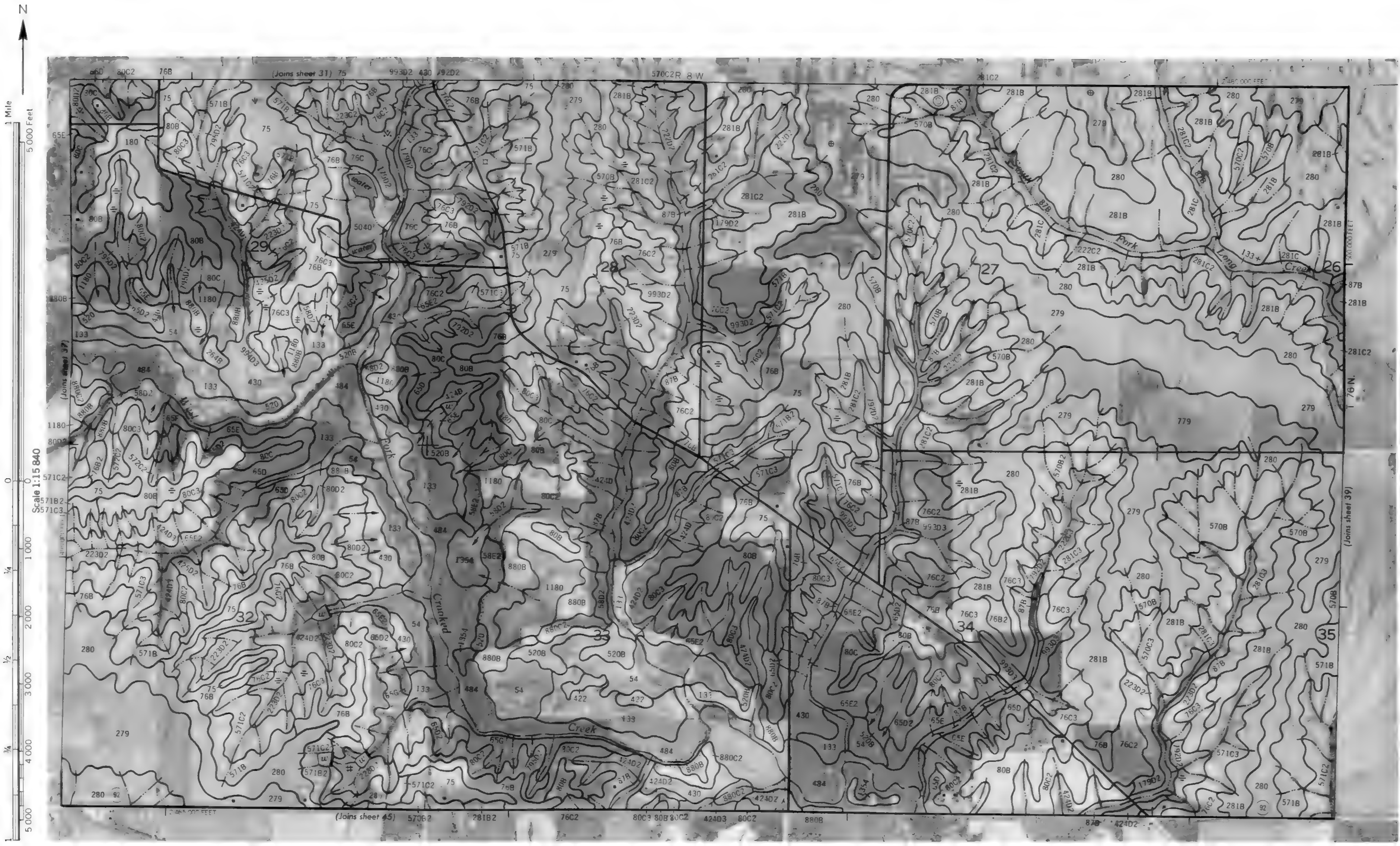

N
1 Mile
5 000 Feet
Scale 1:15 840
R. 7 W.
R. 6 W.
(Joins sheet 27)
(Joins sheet 33)
(Joins sheet 35)
(Joins sheet 41)
T. 76 N.
Goose Creek
13
16
17
18
19
20
21
24
water

N

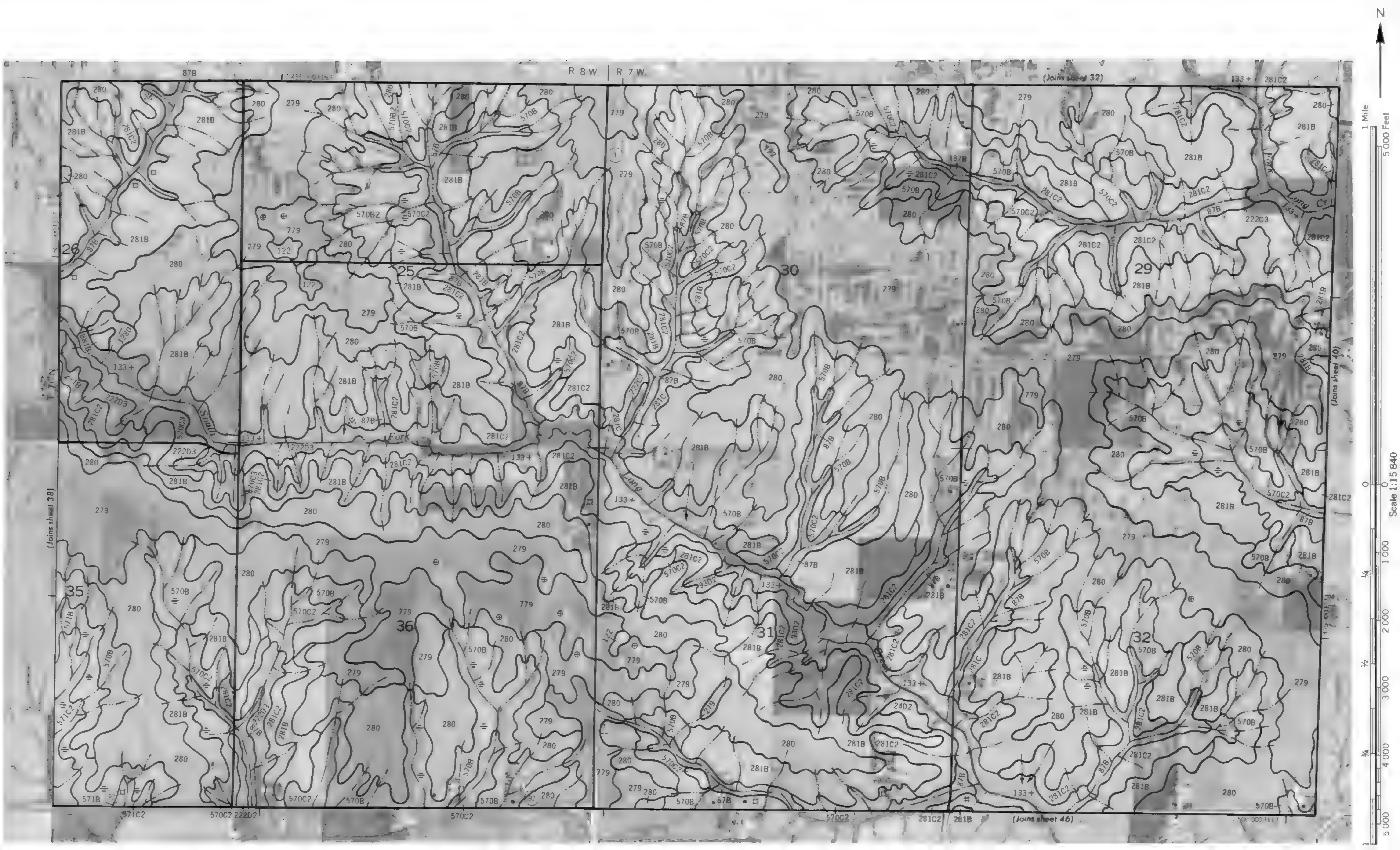

R. 6 W.
T 76 N.
(Joins sheet 28)
(Joins sheet 34)
(Joins sheet 42)
LOUISA COUNTY
Goose Creek
15
14
13
22
23
24
1 Mile
5 000 Feet
Scale 1:15 840
0
1000
2000
3000
4000
5000
1/4
1/2
3/4

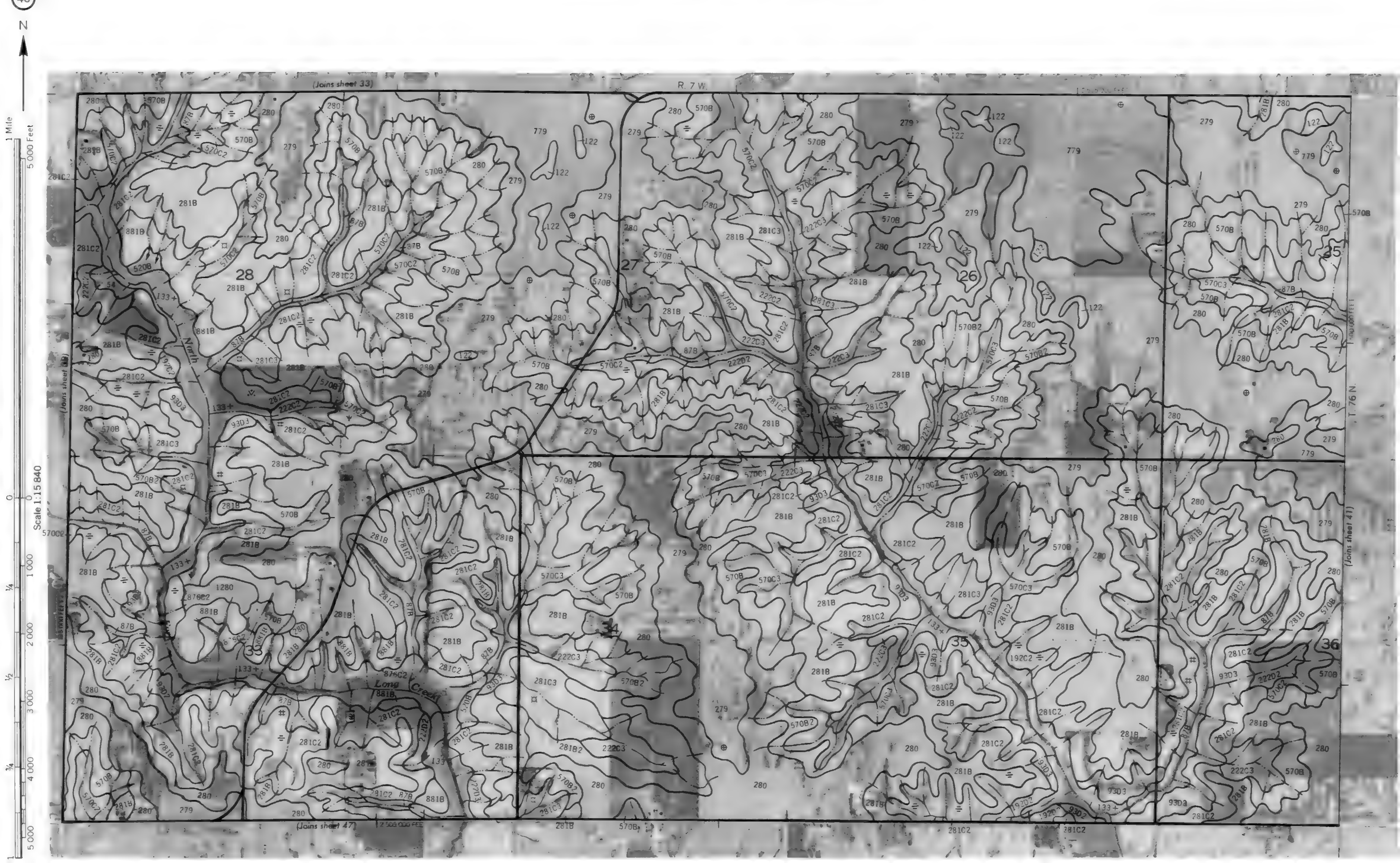

N
(Joins sheet 29)
(Joins sheet 43)
(Joins sheet 37)
KEOKUK COUNTY
Scale 1:15 840
1 Mile
5 000 Feet
R 9 W
T. 76 N.
CHICAGO
AND
PACIFIC
West Fork Crooked Creek
Dutch Creek
28
29
30
31
32
33
34
27

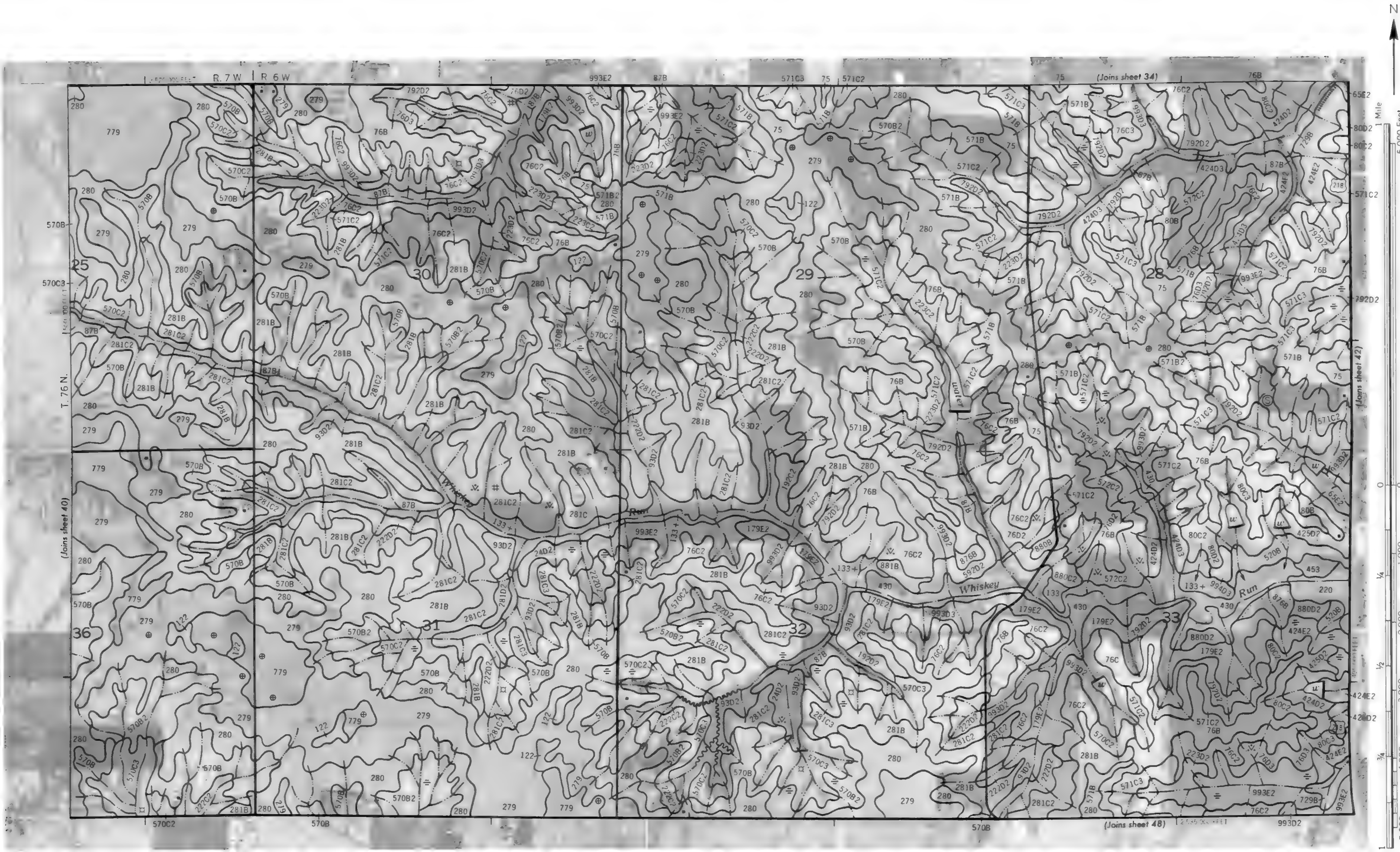

N
(Joins sheet 30)
(Joins sheet 36)
(Joins sheet 38)
(Joins sheet 44)
R 9 W
R 8 W
T. 76 N.
2 450 000 FEET
2 460 000 FEET
West
Fork
Crooked
Creek
CHICAGO
ROCK
ISLAND
AND
PACIFIC
West Chester
25
26
27
30
31
34
35
36
1 Mile
5 000 Feet
Scale 1:15 840
0
1/4
1/2
3/4
1 000
2 000
3 000
4 000
5 000


N
1 Mile
5 000 Feet
Scale 1:15 840
(Joins sheet 31)
(Joins sheet 37)
(Joins sheet 39)
(Joins sheet 45)
R. 8 W.
T. 76 N.
Crooked Creek
Long Creek

39


N
R 8 W.
R 7 W.
(Joins sheet 32)
(Joins sheet 38)
(Joins sheet 40)
(Joins sheet 46)
25
26
29
30
31
32
35
36
Smith
Fork
Long
Long Cr.
Fork
Crooked
1 Mile
5 000 Feet
Scale 1:15 840
0
1/4
1/2
3/4
1 000
2 000
3 000
4 000
5 000


N
1 Mile
5 000 Feet
Scale 1:15 840
(Joins sheet 33)
R. 7 W.
(Joins sheet 47)
(Joins sheet 41)
T. 76 N.
North
Long Creek
28
27
26
25
33
34
35
36

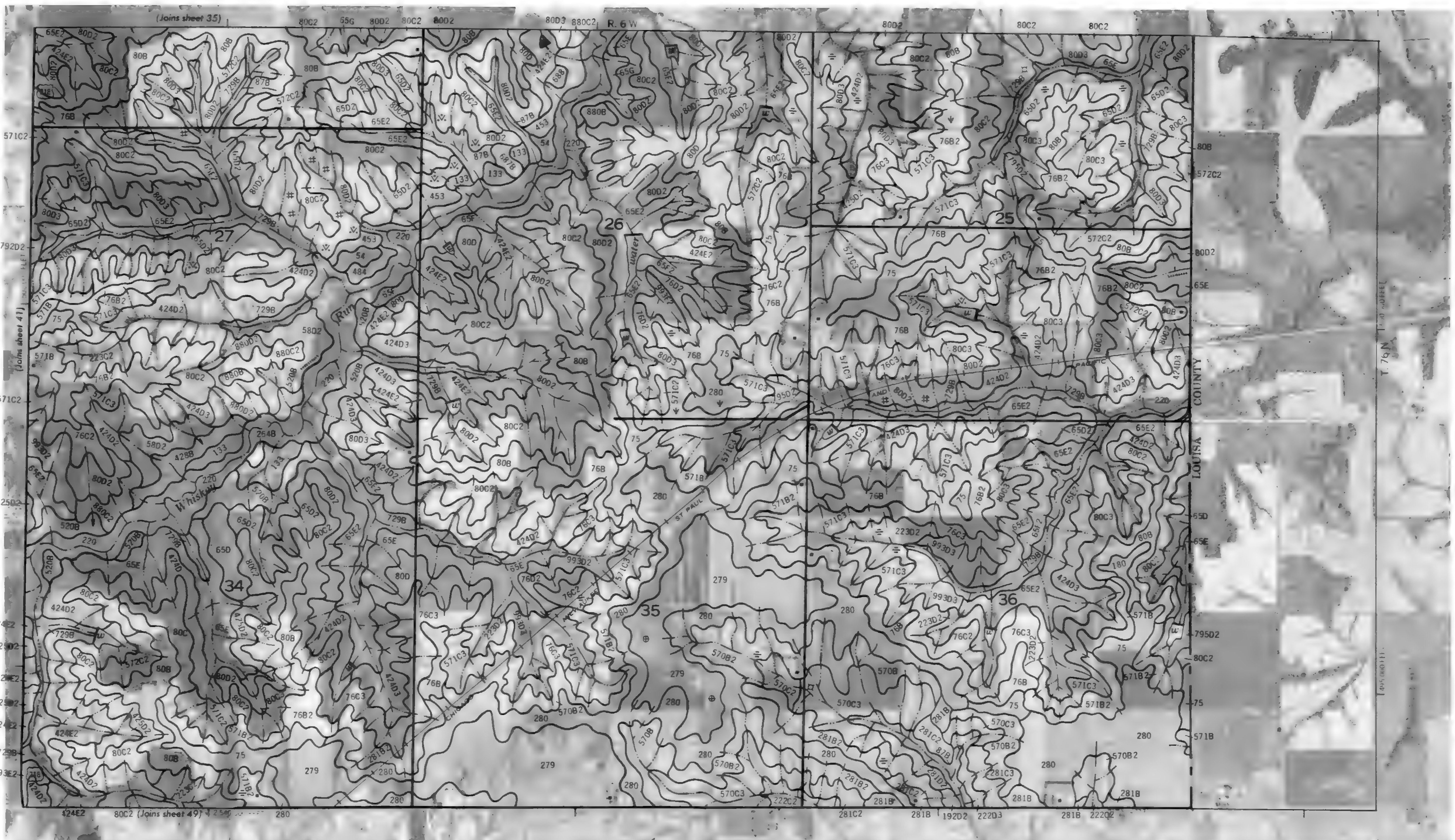

R. 7 W
R. 6 W
T. 76 N.
(Joins sheet 34)
(Joins sheet 40)
(Joins sheet 42)
(Joins sheet 48)
25
29
30
28
36
31
32
33
Whiskey
Run
N
1 Mile
5 000 Feet
Scale 1:15 840

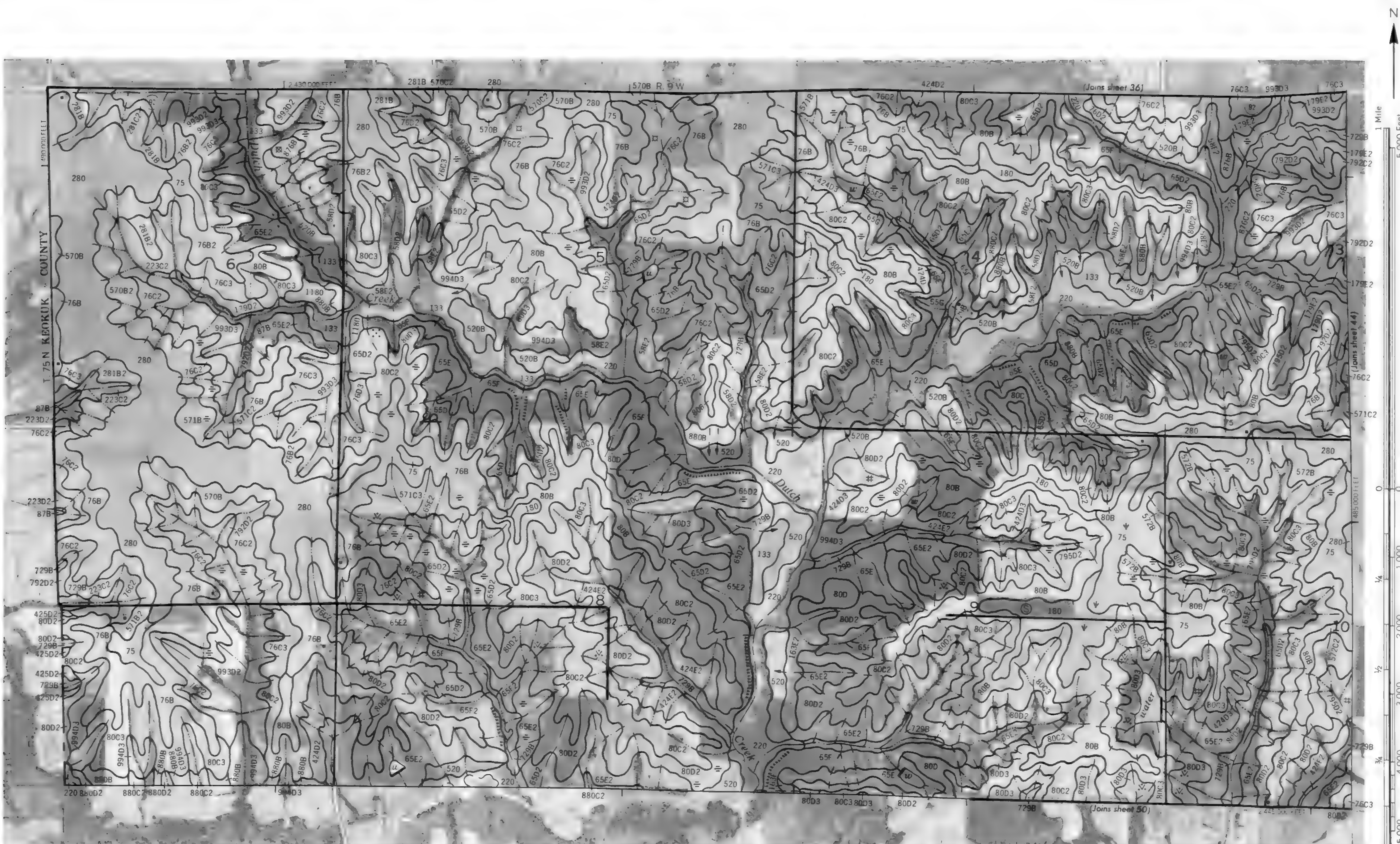
N

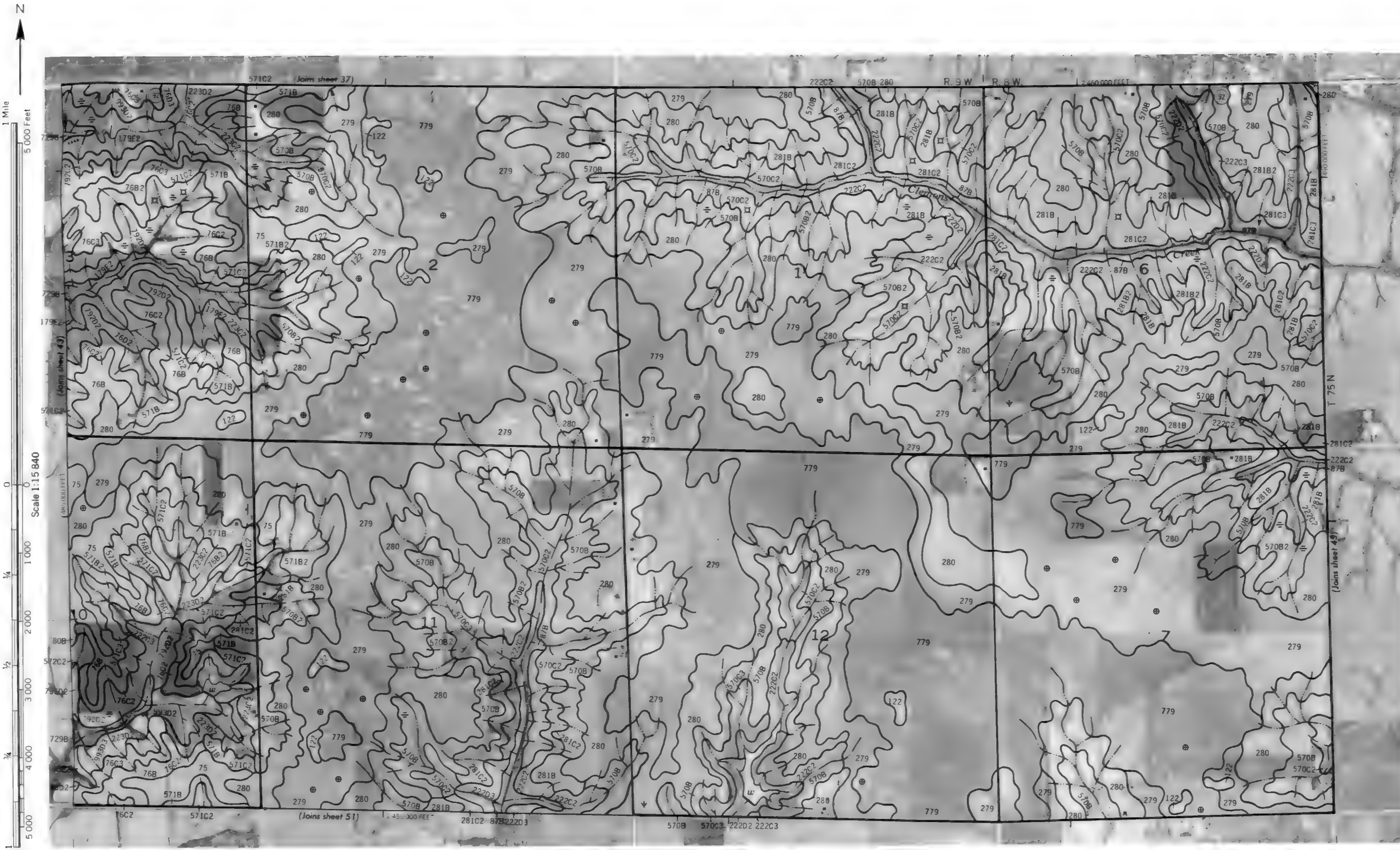
1 Mile

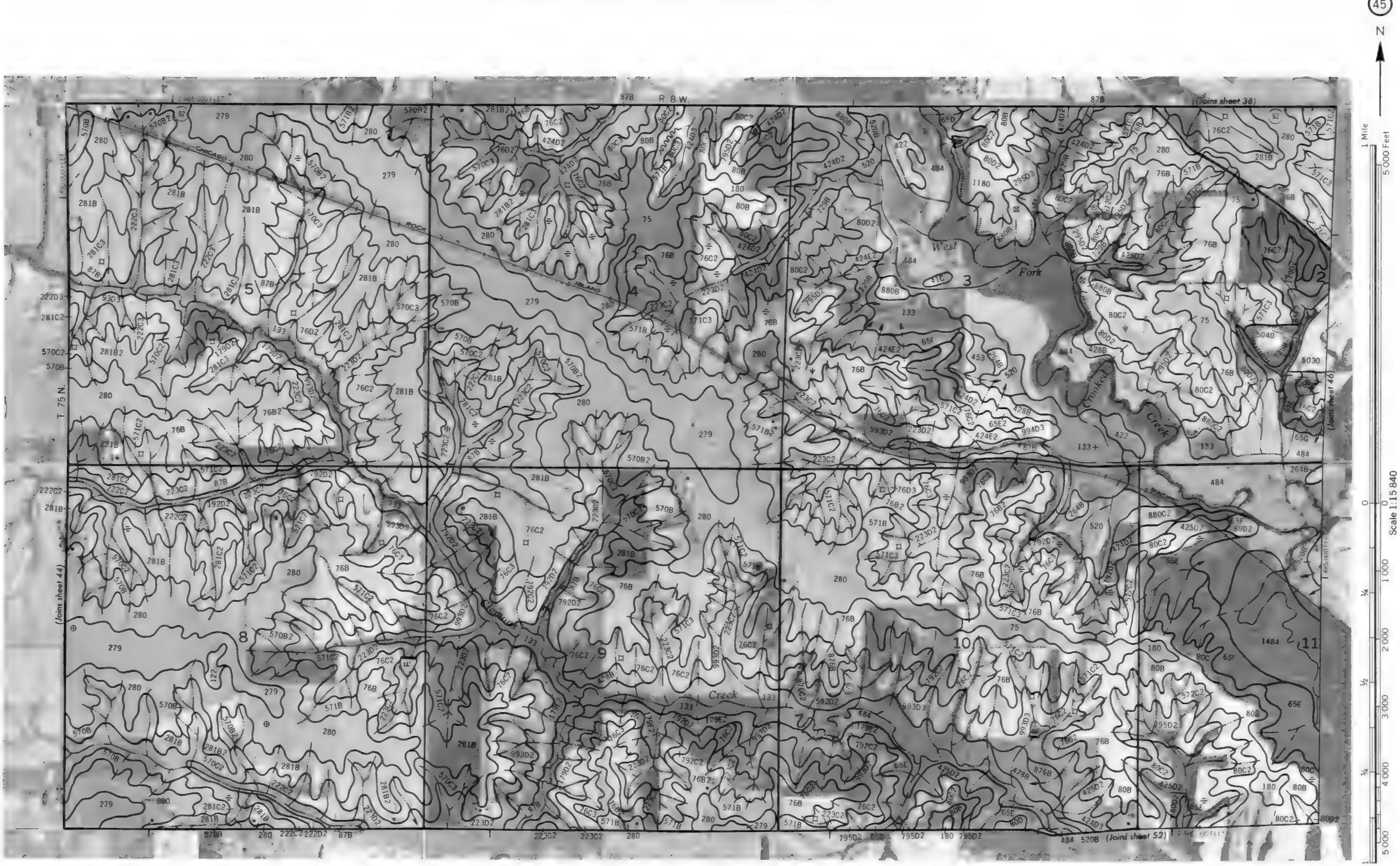
5 000 Feet

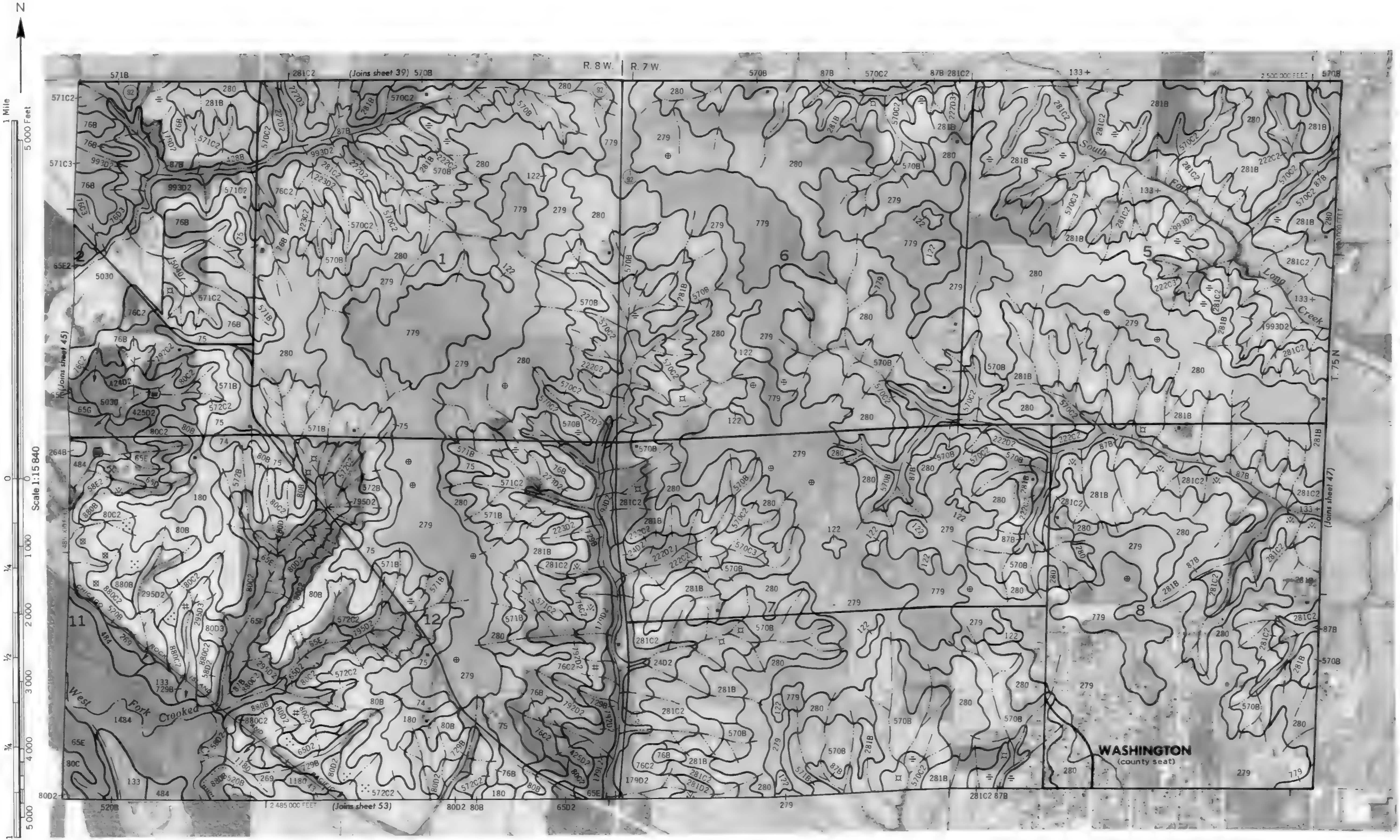
Scale 1:15 840

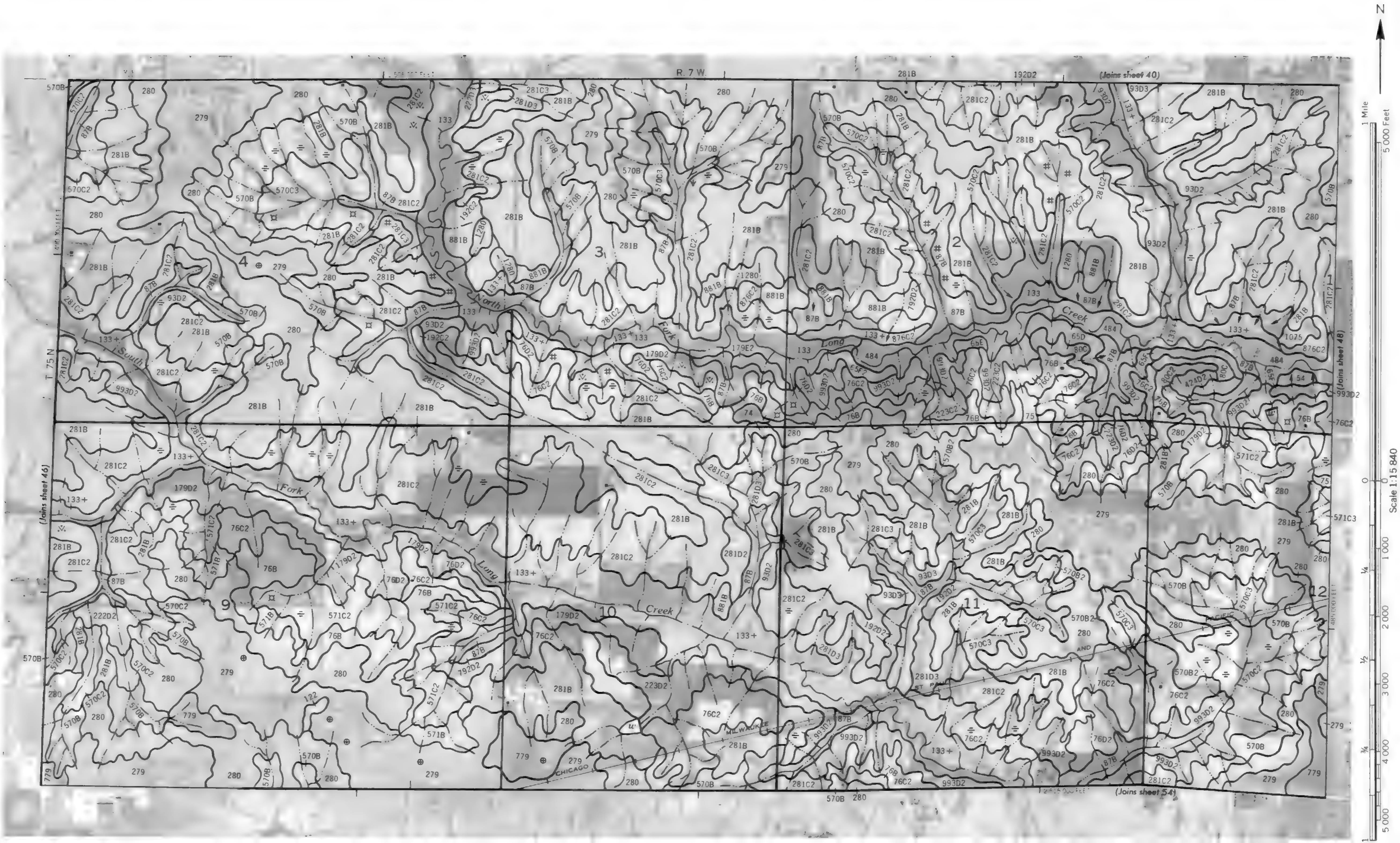


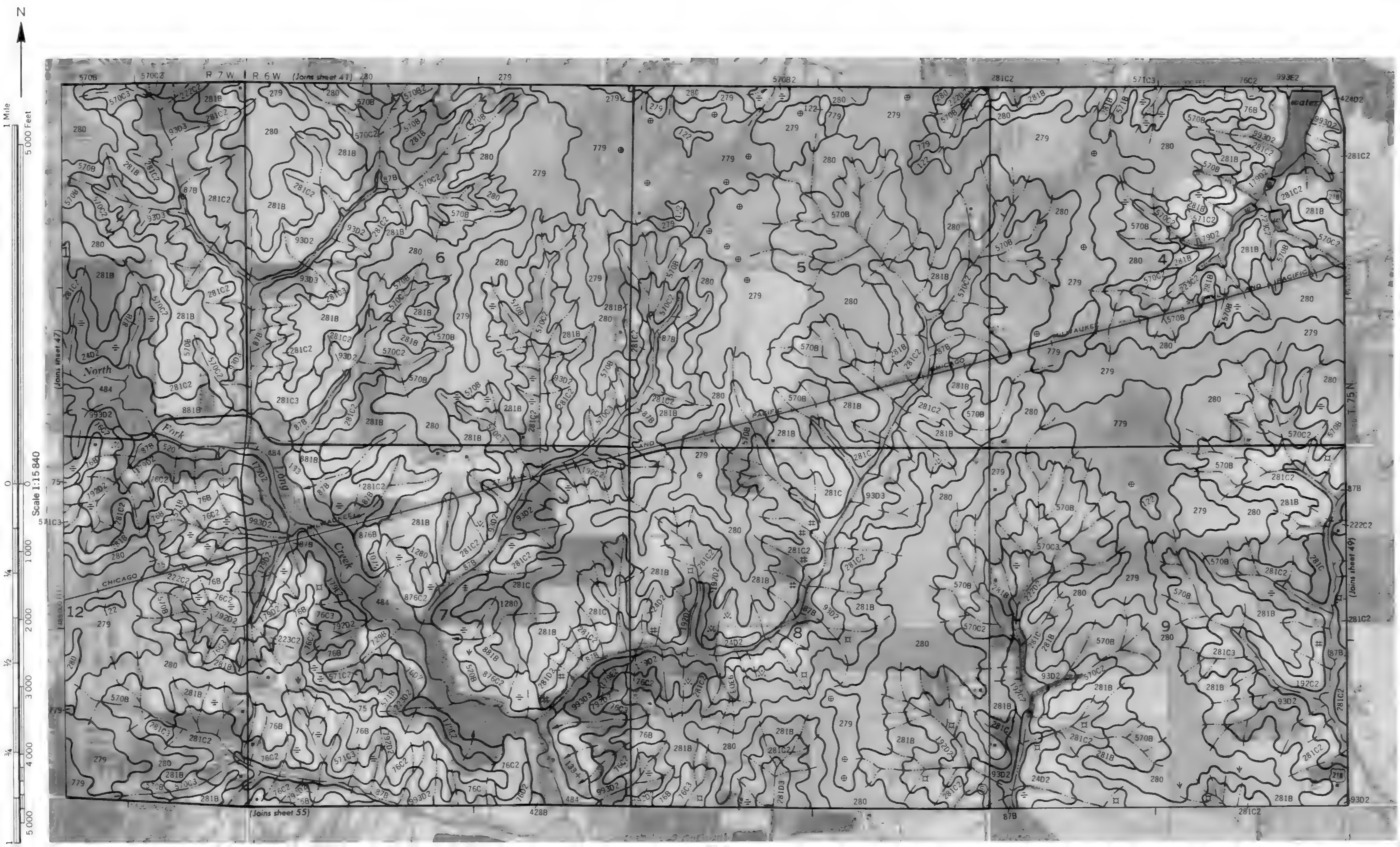

N
(Joins sheet 36)
(Joins sheet 44)
(Joins sheet 50)
KEOKUK COUNTY
T 75 N
R. 9 W
Dutch Creek
Creek
1 Mile
5 000 Feet
Scale 1:15 840

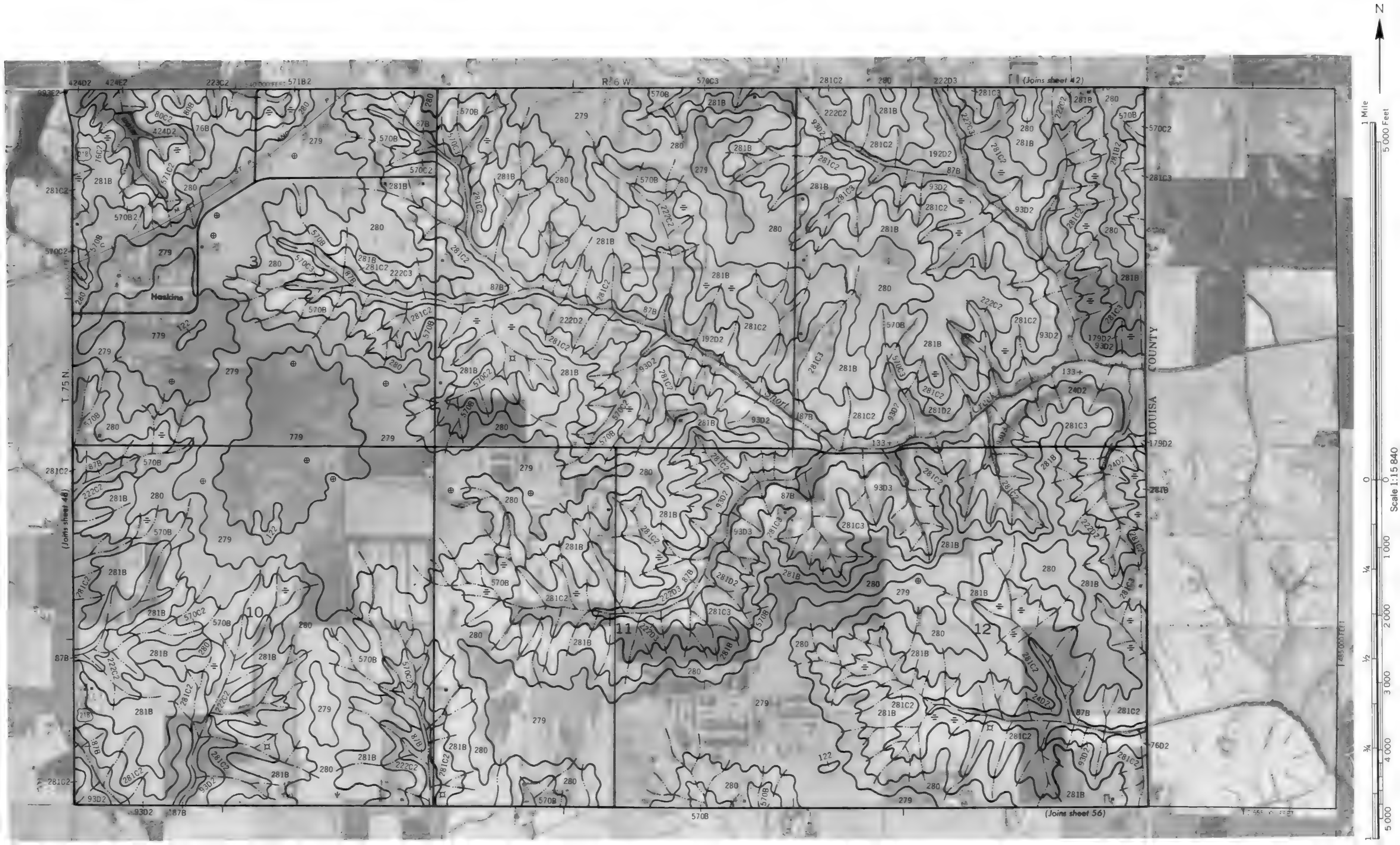

N
1 Mile
5 000 Feet
Scale 1:15 840
(Joins sheet 37)
(Joins sheet 51)
(Joins sheet 43)
(Joins sheet 45)
R. 9 W.
R. 8 W.
T. 75 N
Clemons
Creek
1
2
6
7
11
12

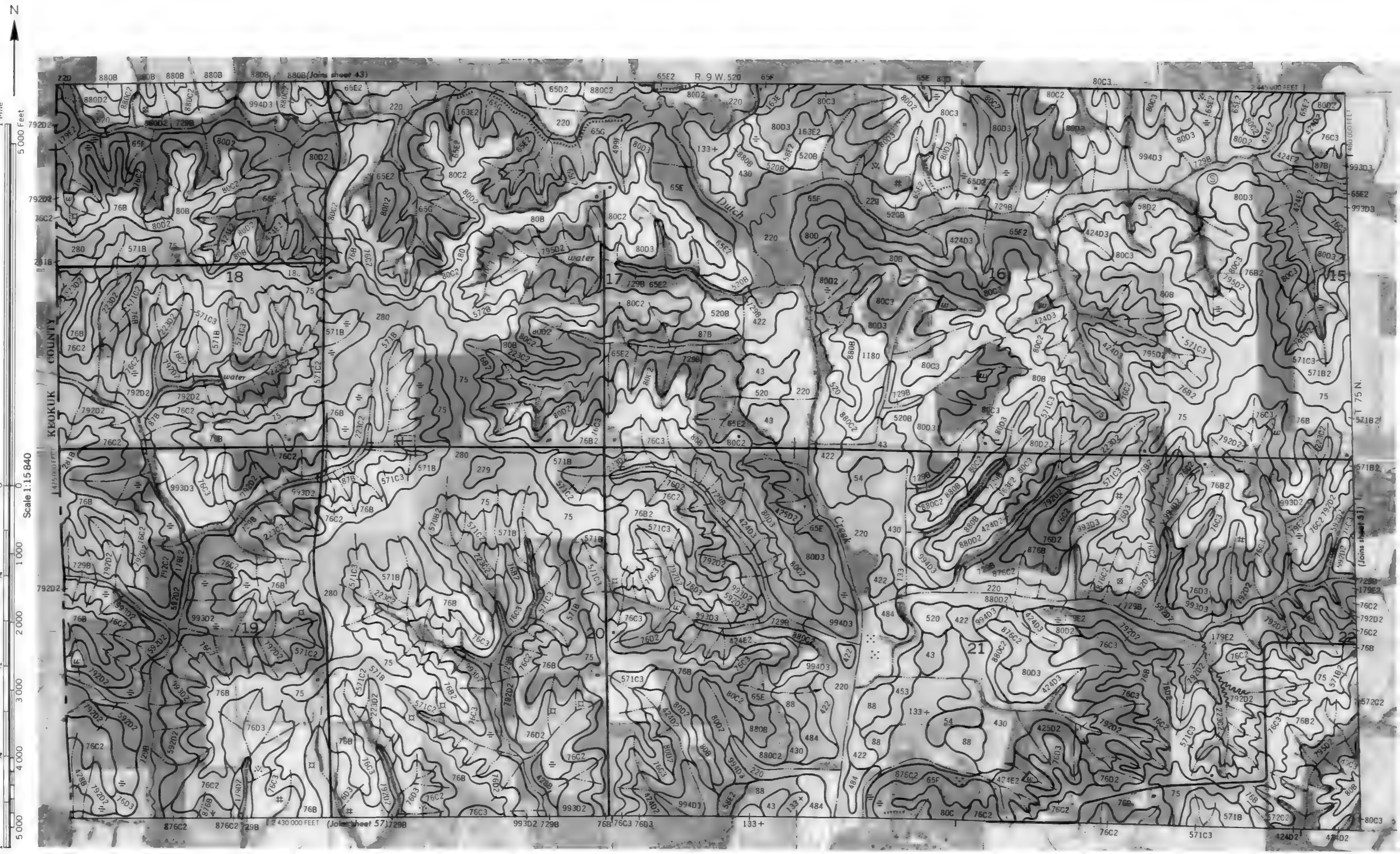

45
N
R 8 W.
T. 75 N.
(Joins sheet 38)
(Joins sheet 44)
(Joins sheet 46)
(Joins sheet 52)
West Fork
Crooked Creek
Creek
1 Mile
5 000 Feet
Scale 1:15 840


N
1 Mile
5 000 Feet
Scale 1:15 840
(Joins sheet 39)
(Joins sheet 45)
(Joins sheet 47)
(Joins sheet 53)
R. 8 W.
R. 7 W.
T. 75 N.
2 500 000 FEET
2 485 000 FEET
South Fork Long Creek
West Fork Crooked
WASHINGTON
(county seat)


N
R. 7 W.
T 75 N
(Joins sheet 40)
(Joins sheet 48)
(Joins sheet 54)
(Joins sheet 46)
North Fork
South Fork
Long Creek
MILWAUKEE
CHICAGO
PACIFIC
1 Mile
5 000 Feet
Scale 1:15 840

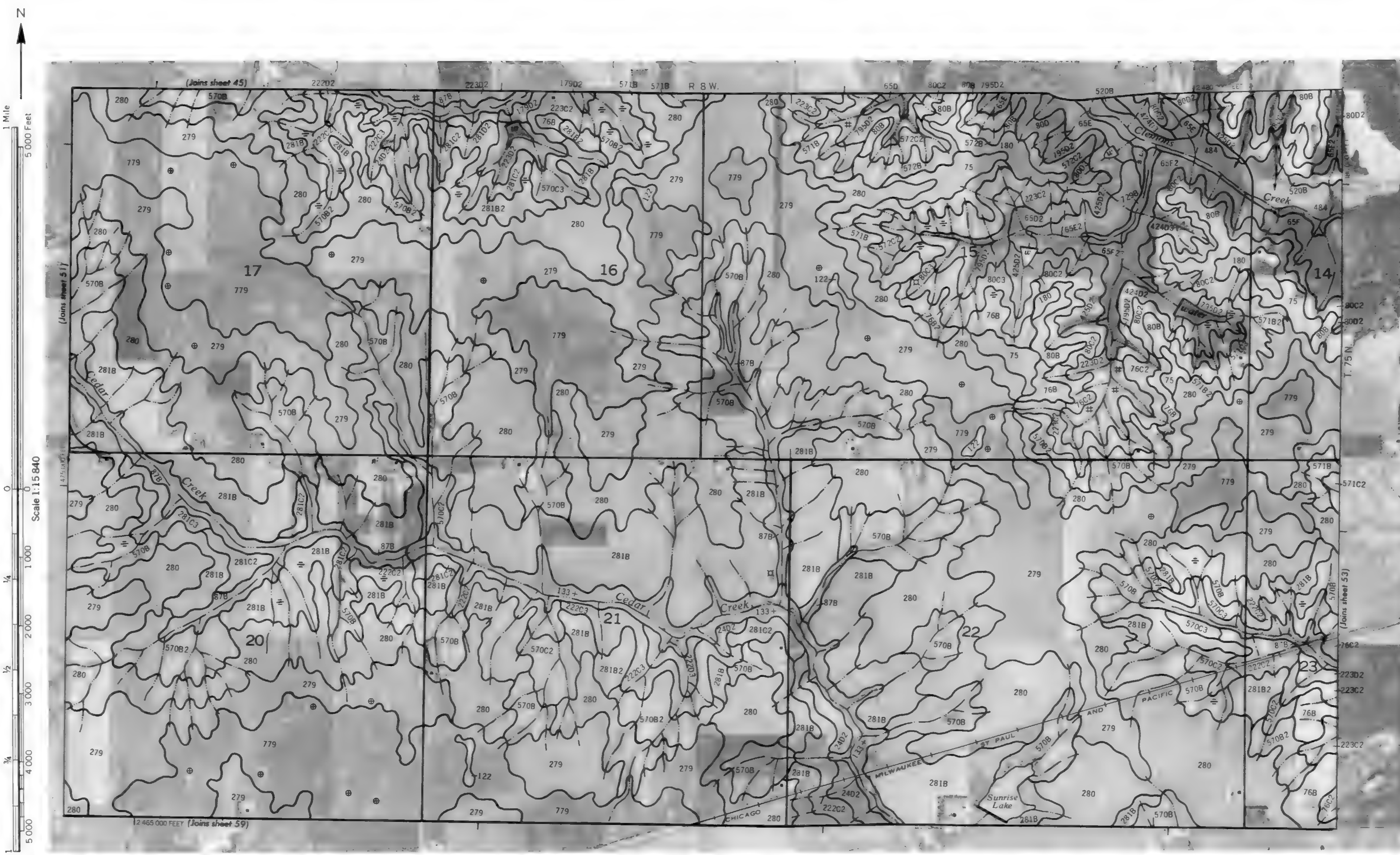

N
1 Mile
5 000 Feet
Scale 1:15 840
R 7 W
R 6 W
(Joins sheet 41)
(Joins sheet 47)
(Joins sheet 49)
(Joins sheet 55)
T. 75 N.
North Fork
Long Creek
CHICAGO
water


R. 6 W.
T. 75 N.
(Joins sheet 42)
(Joins sheet 48)
(Joins sheet 56)
LOUISA COUNTY
Haskins
Short Creek
1 Mile
5 000 Feet
Scale 1:15 840
N

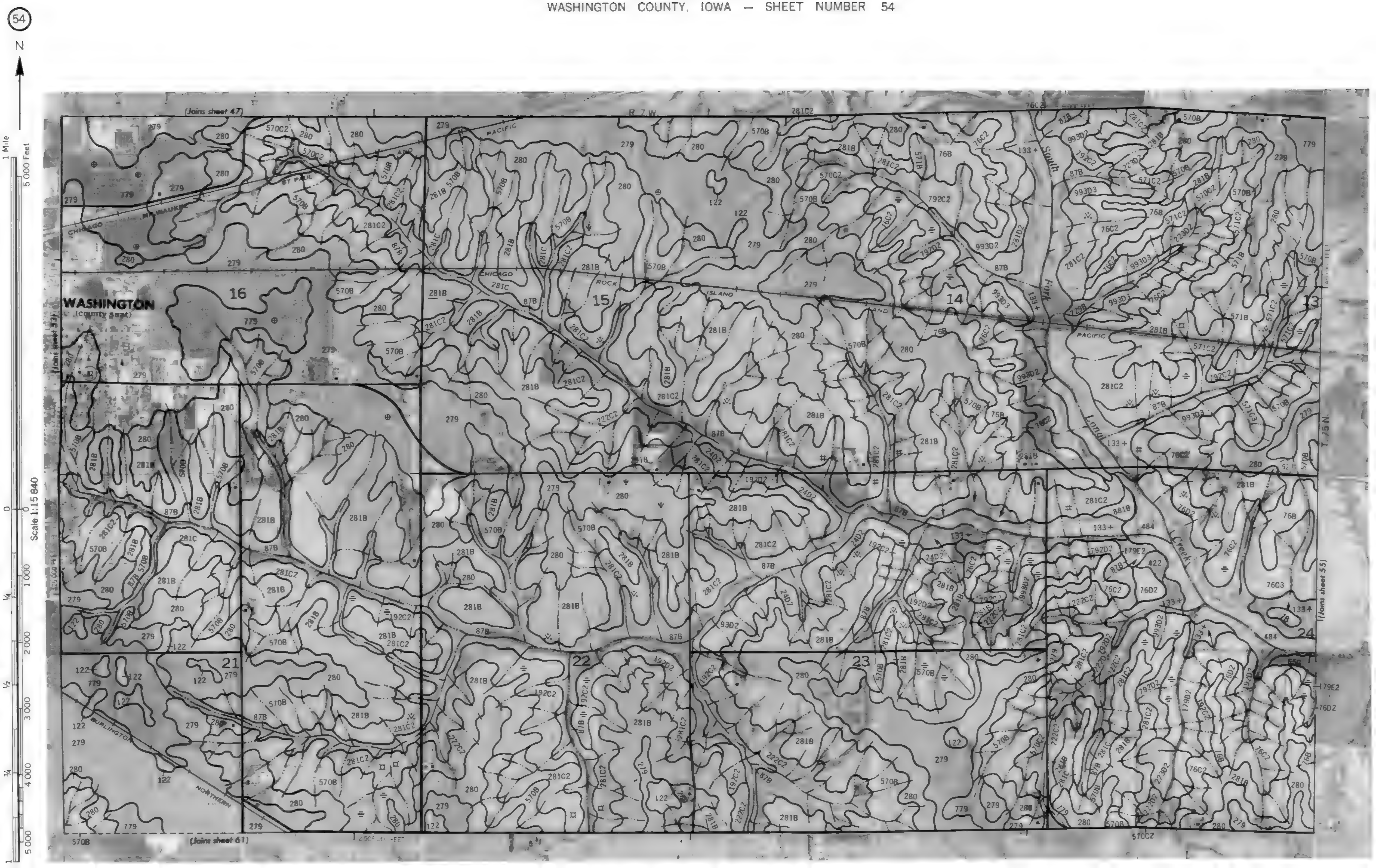

N
1 Mile
5 000 Feet
Scale 1:15 840
(Joins sheet 43)
R. 9 W.
T. 75 N.
(Joins sheet 51)
(Joins sheet 57)
KEOKUK COUNTY
Dutch
Creek
water
15
16
17
18
19
20
21
22

51

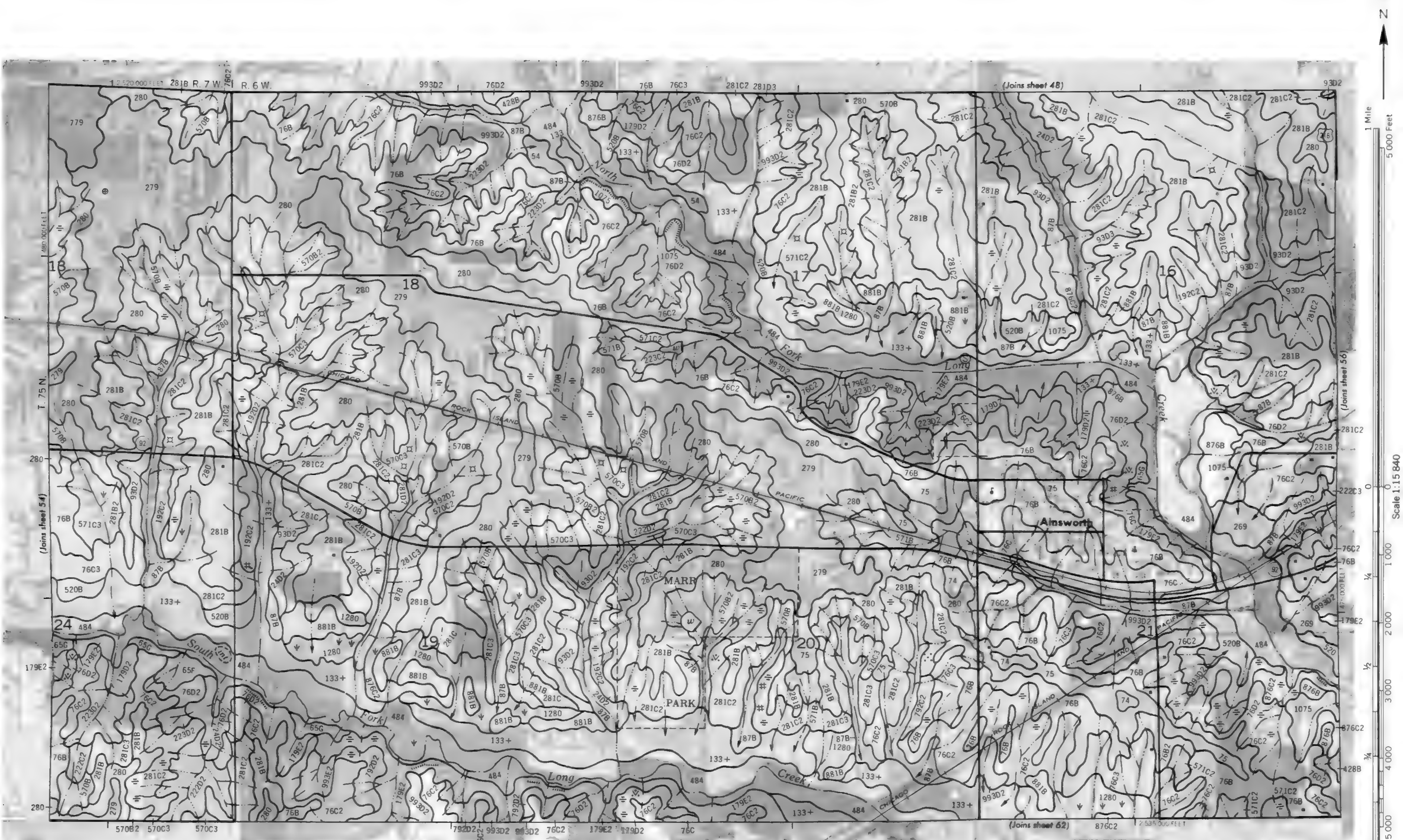

(Joins sheet 44)
(Joins sheet 52)
(Joins sheet 58)
(Joins sheet 50)
R. 9 W.
R. 8 W.
T. 75 N.
N
1 Mile
5 000 Feet
Scale 1:15 840
water

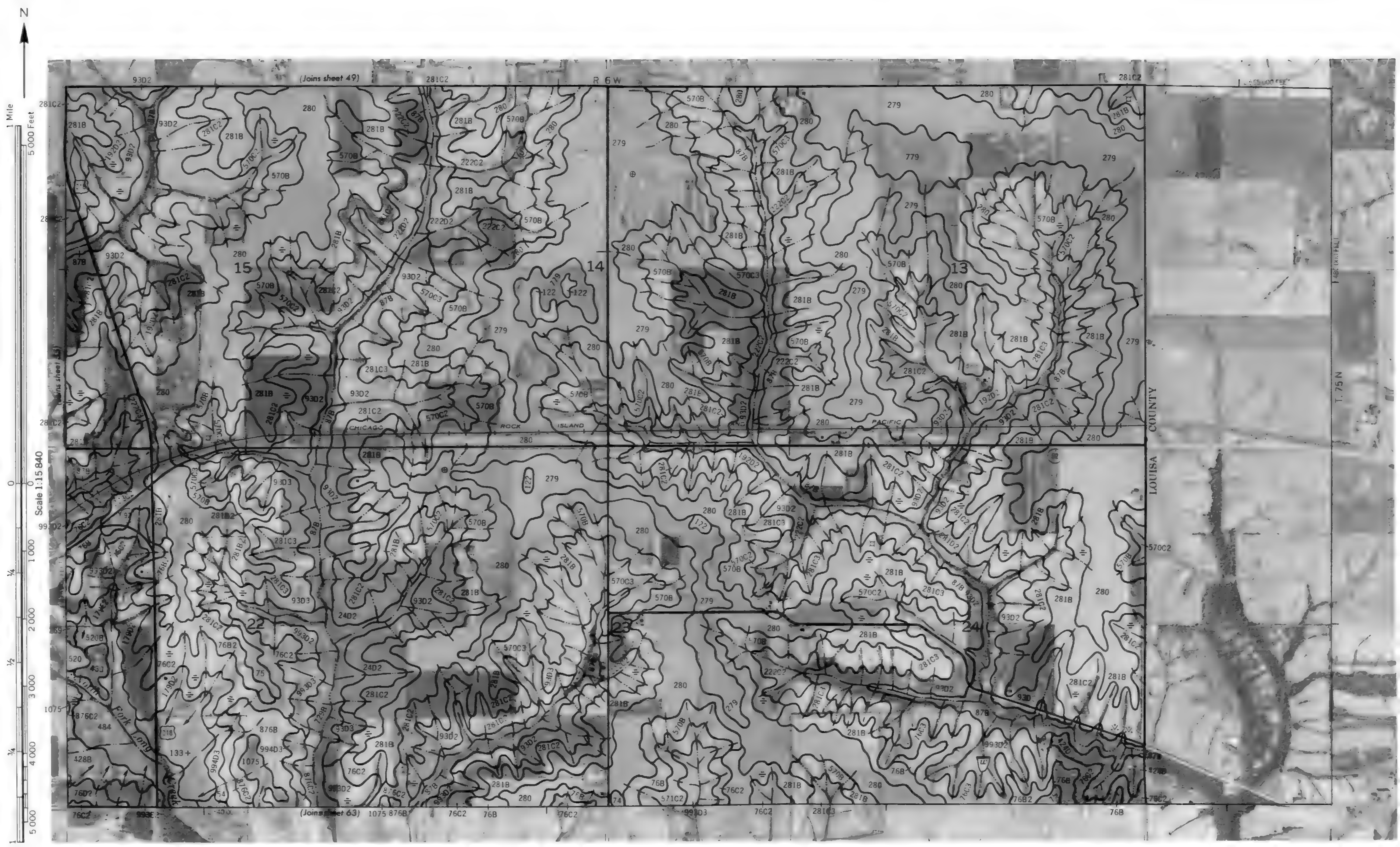

N
1 Mile
5 000 Feet
0
1/4
1/2
3/4
1
Scale 1:15 840
0
1 000
2 000
3 000
4 000
5 000
(Joins sheet 45)
R 8 W.
(Joins sheet 51)
(Joins sheet 53)
2 465 000 FEET (Joins sheet 59)
T. 75 N.
17
16
15
14
20
21
22
23
Cedar
Creek
Cedar
Creek
Clemons
Creek
water
Sunrise
Lake
CHICAGO
MILWAUKEE
ST PAUL
AND
PACIFIC

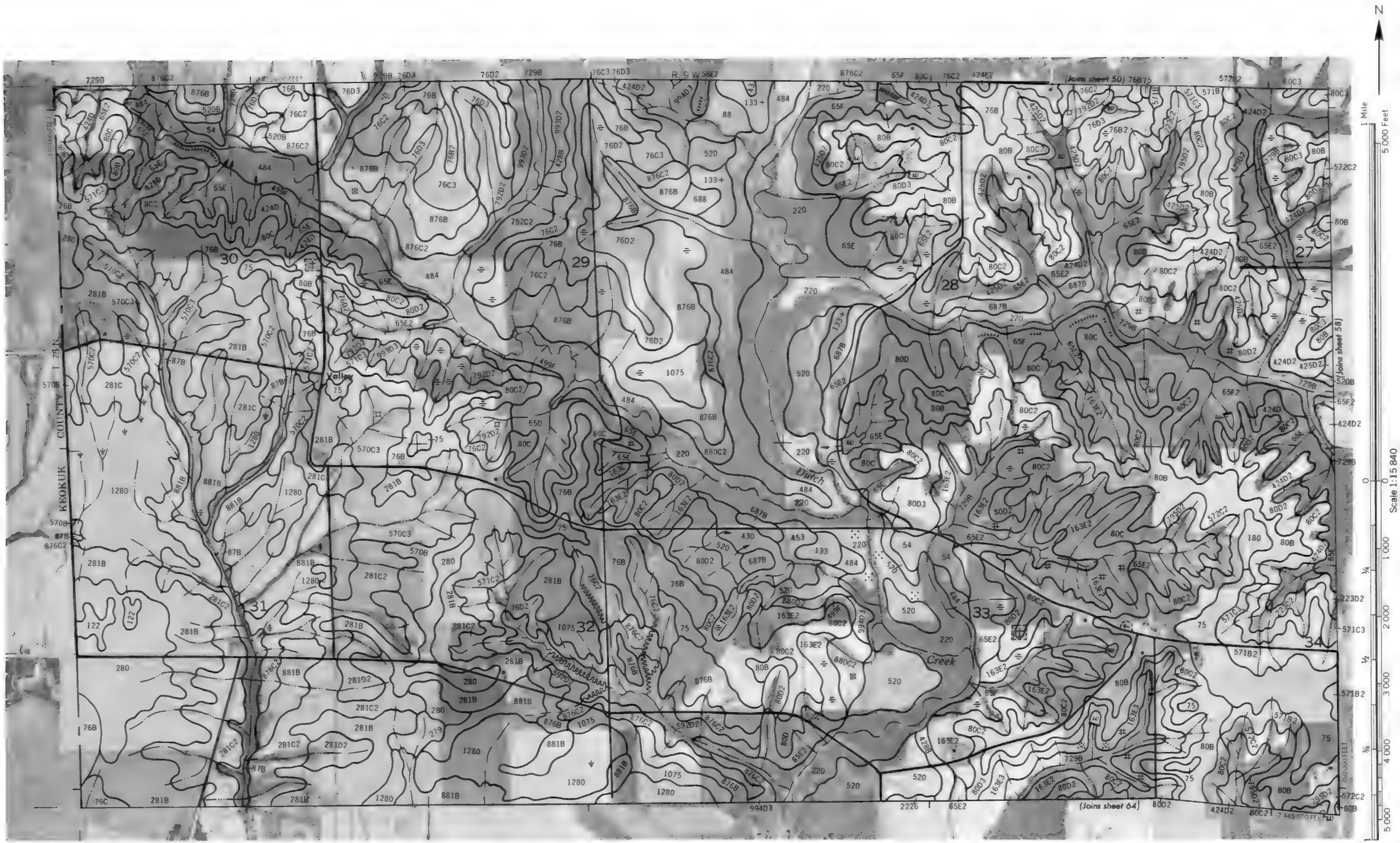

N
R. 8 W.
R. 7 W.
T. 75 N.
(Joins sheet 46)
(Joins sheet 52)
(Joins sheet 54)
(Joins sheet 60)
WASHINGTON
(county seat)
HAYES TIMBER COUNTY PARK
Clemons Creek
West
Fork
Crooked Creek
1 Mile
5 000 Feet
Scale 1:15 840

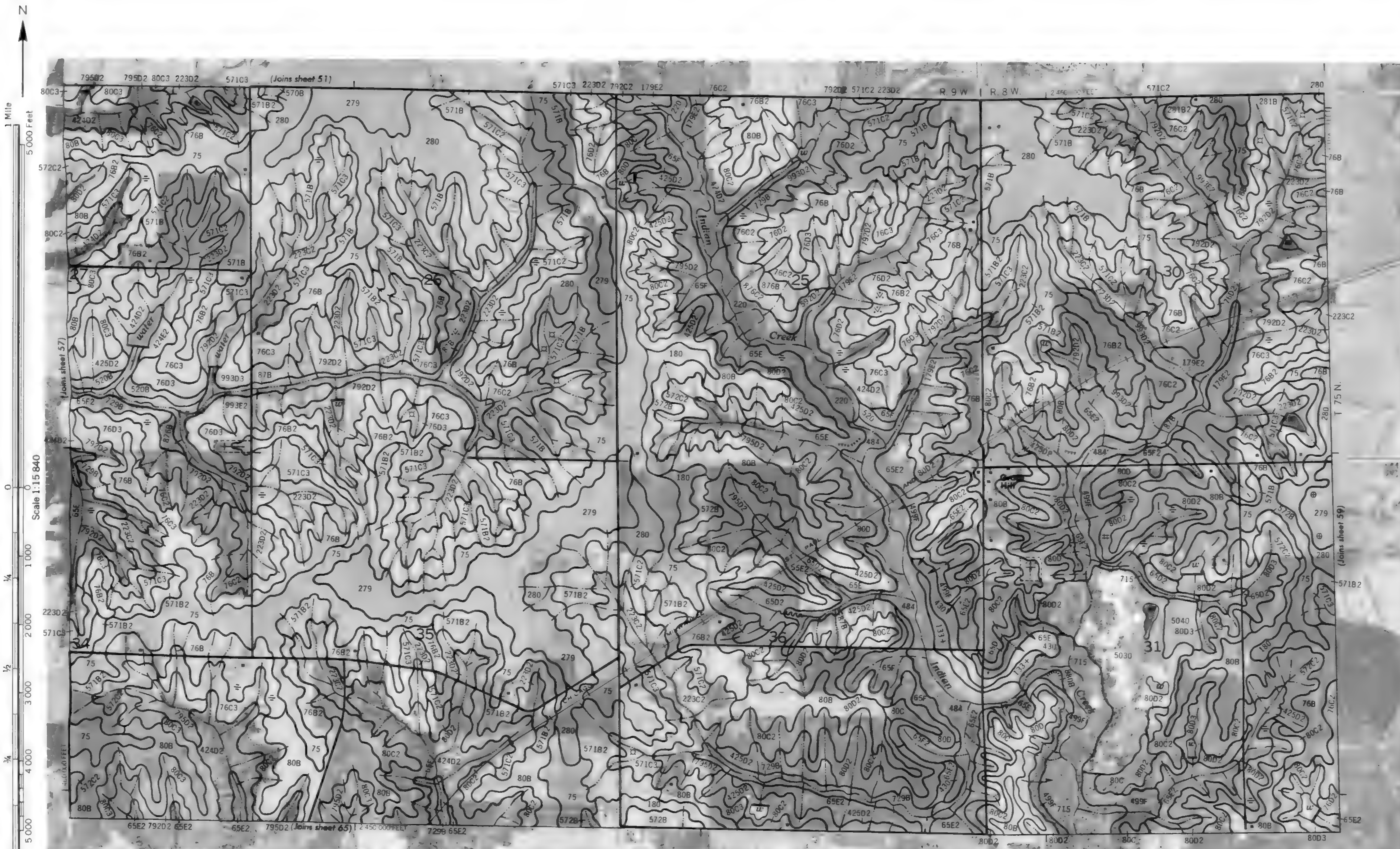


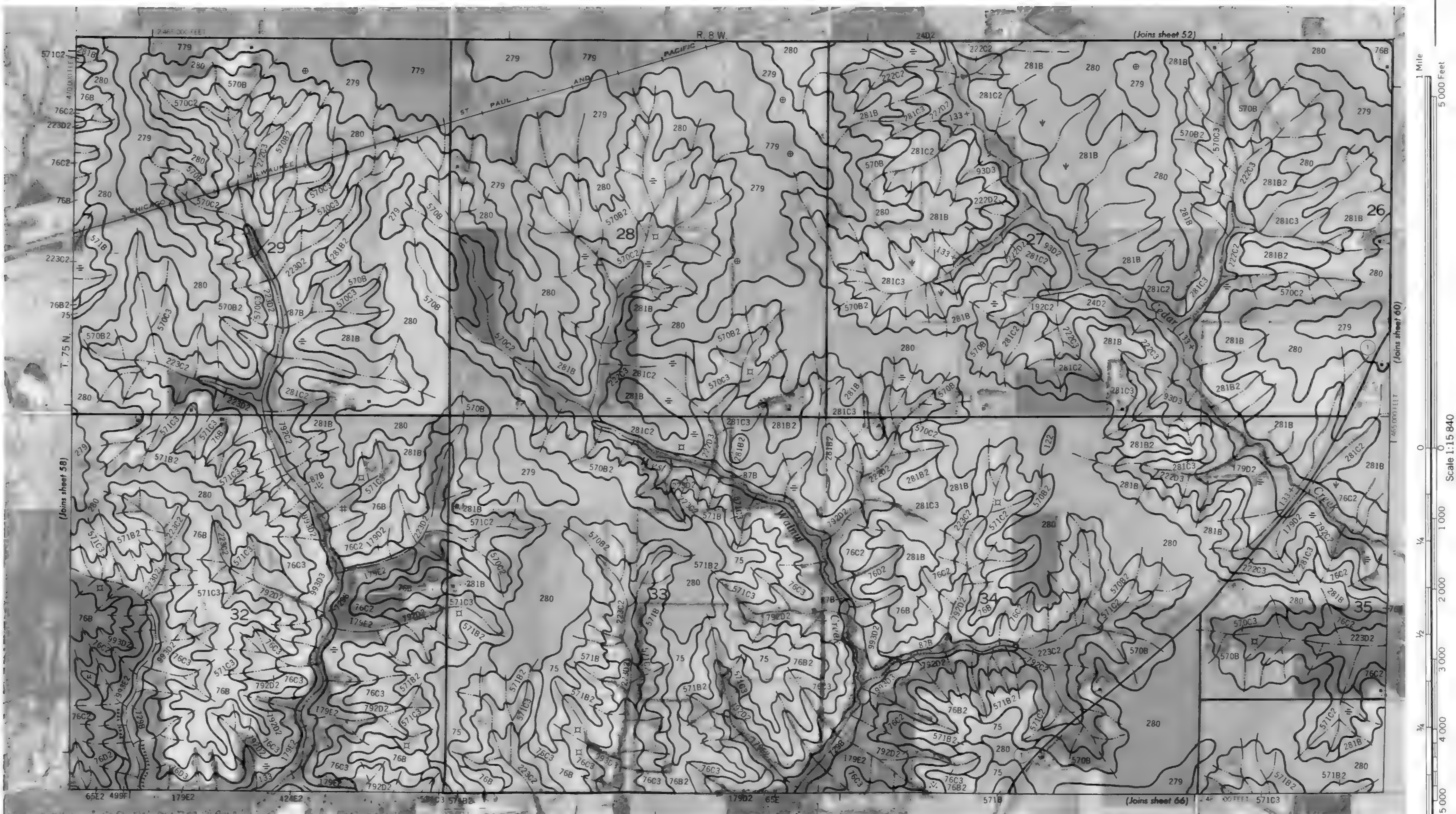
54
N
1 Mile
5 000 Feet
Scale 1:15 840
(Joins sheet 47)
(Joins sheet 61)
(Joins sheet 55)
R. 7 W.
T. 75 N.
WASHINGTON
(county seat)
CHICAGO MILWAUKEE ST PAUL AND PACIFIC
CHICAGO ROCK ISLAND AND PACIFIC
BURLINGTON NORTHERN
South Fork Long Creek

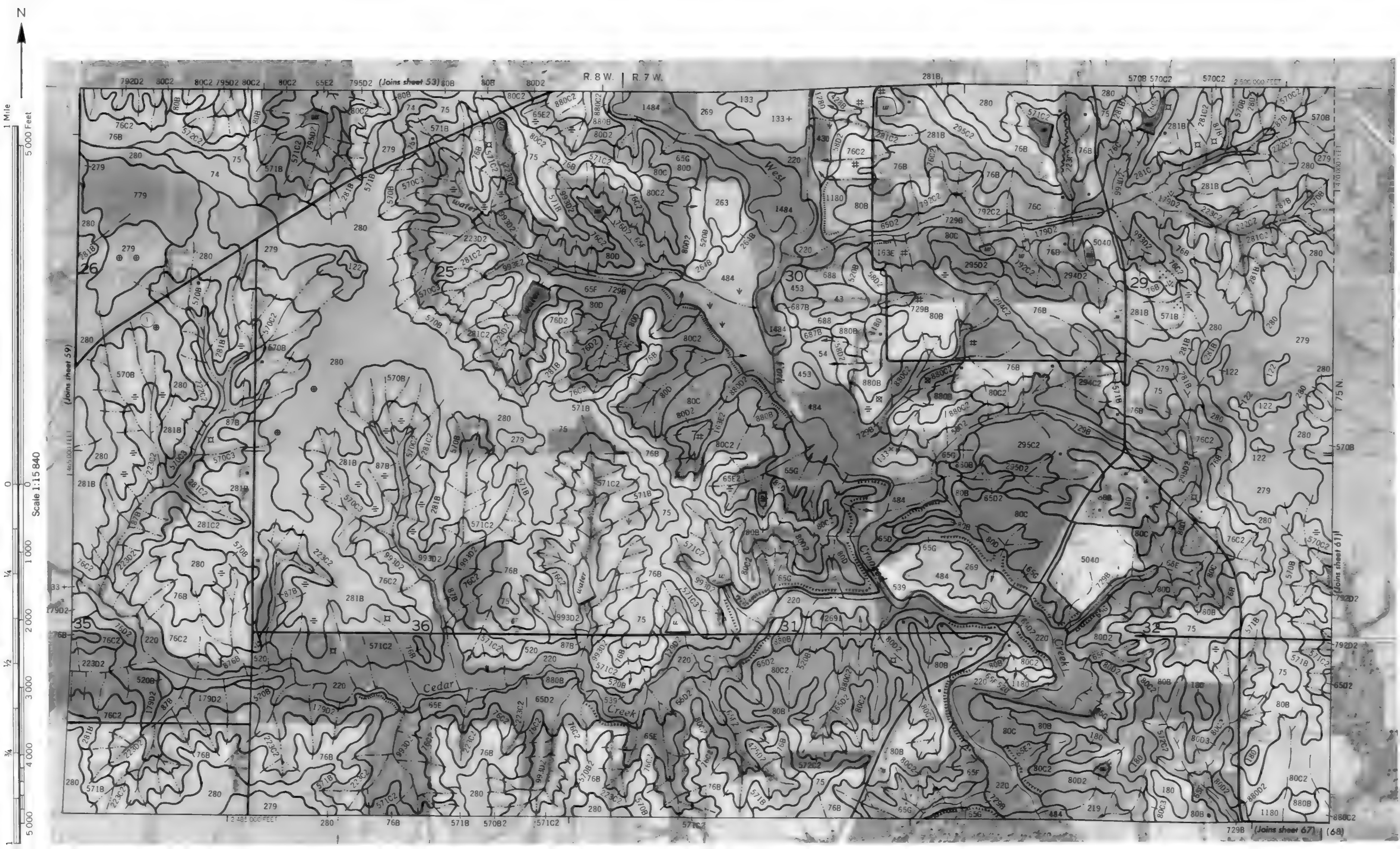

N
R. 7 W.
R. 6 W.
(Joins sheet 48)
(Joins sheet 56)
(Joins sheet 62)
(Joins sheet 54)
T. 75 N.
1 520 000 FEET
480 000 FEET
2 535 000 FEET
North
Fork
Long
Creek
South
Fork
Long
Creek
CHICAGO
ROCK
ISLAND
AND
PACIFIC
Ainsworth
MARR
PARK
18
17
16
13
24
19
20
21
1 Mile
5 000 Feet
Scale 1:15 840
0
1000
2000
3000
4000
5000
¼
½
¾

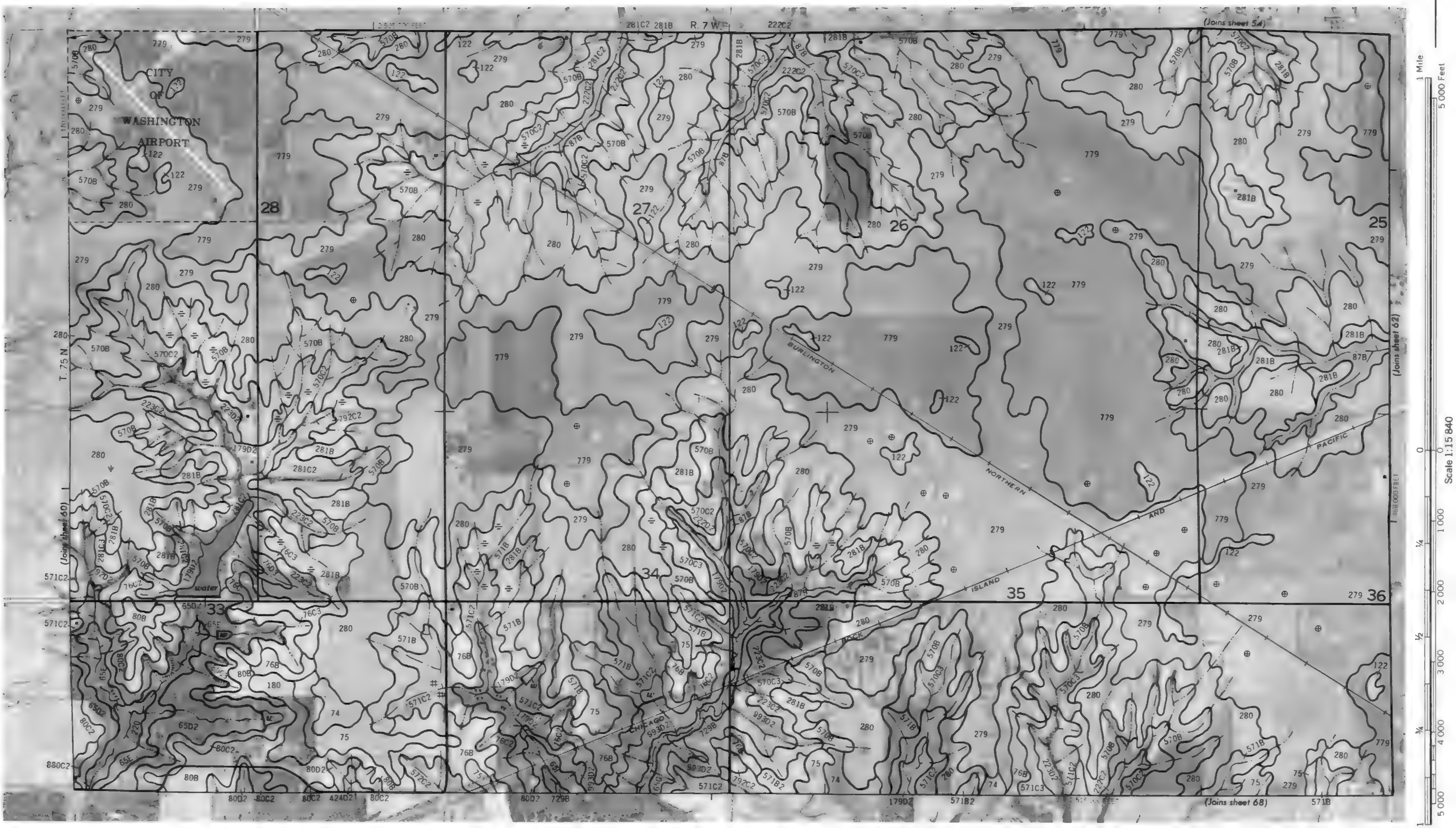

N
1 Mile
5 000 Feet
Scale 1:15 840
(Joins sheet 49)
(Joins sheet 63)
R 6 W
T. 75 N
LOUISA
COUNTY
CHICAGO
ROCK
ISLAND
PACIFIC
15
14
13
22
23
24
Long
Fork

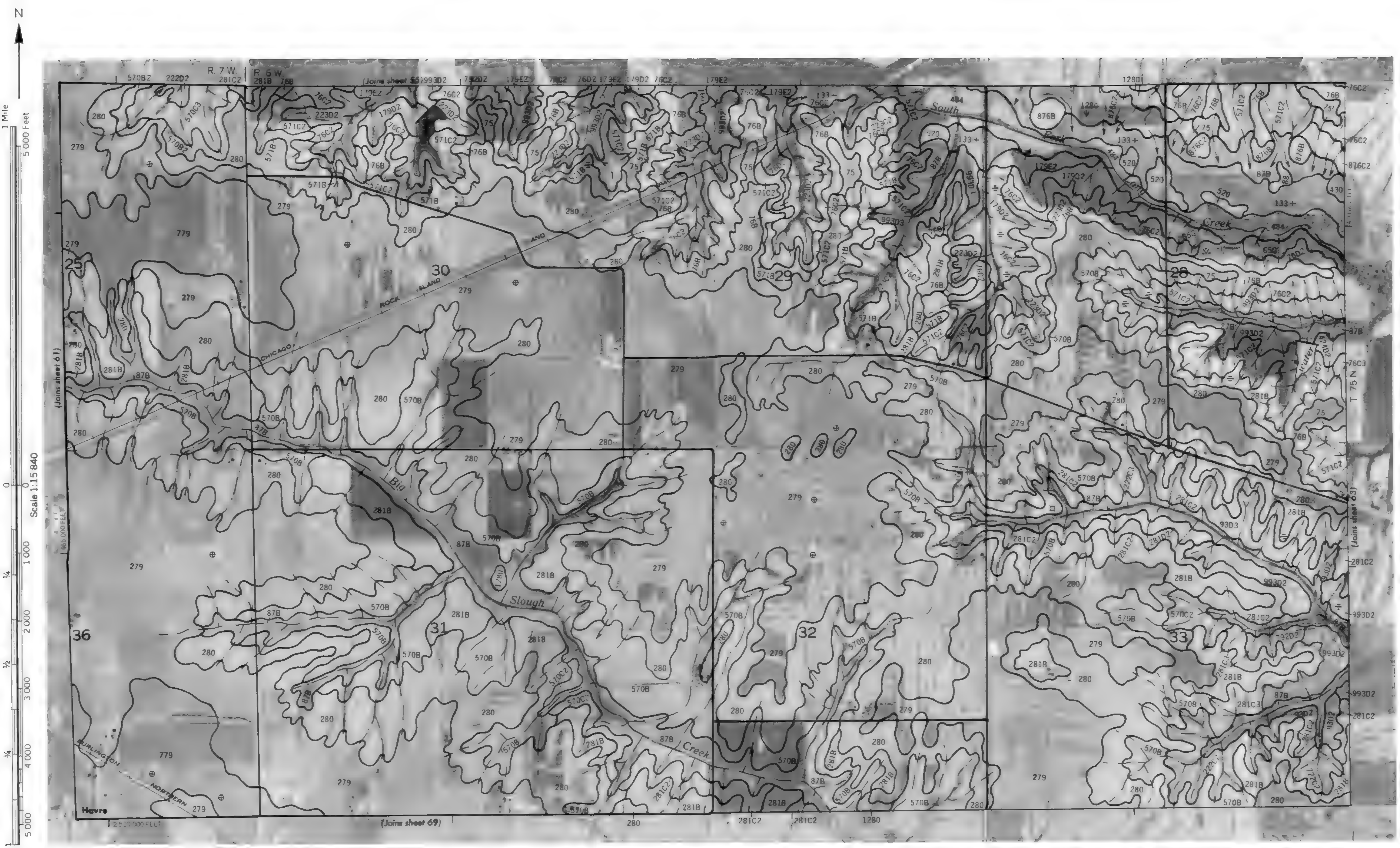

N
(Joins sheet 50)
(Joins sheet 58)
(Joins sheet 64)
R. 9 W.
T. 75 N.
KEOKUK COUNTY
Valley
Dutch
Creek
30
29
28
27
31
32
33
34
1 Mile
5 000 Feet
Scale 1:15 840
0
1 000
2 000
3 000
4 000
5 000
1/4
1/2
3/4

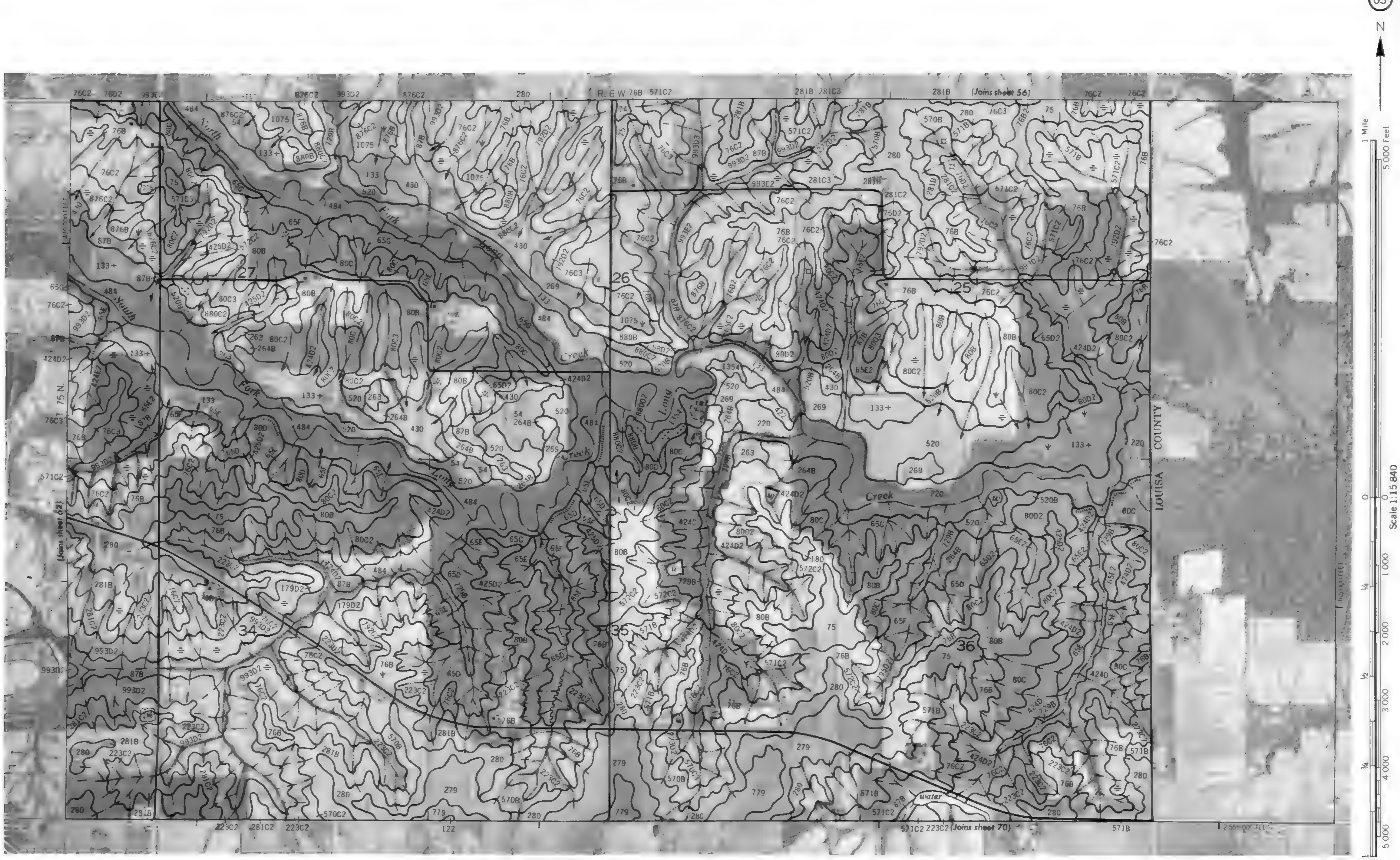

N
1 Mile
5 000 Feet
Scale 1:15 840
(Joins sheet 51)
(Joins sheet 57)
(Joins sheet 59)
(Joins sheet 65)
R. 9 W.
R. 8 W.
T. 75 N.
Indian Creek
water
26
25
30
27
34
35
36
31


R. 8 W.
(Joins sheet 52)
(Joins sheet 60)
(Joins sheet 66)
(Joins sheet 58)
T. 75 N.
CHICAGO MILWAUKEE ST PAUL AND PACIFIC
Cedar Creek
Walnut Creek
N
1 Mile
5 000 Feet
Scale 1:15 840


N
1 Mile
5 000 Feet
Scale 1:15 840
R. 8 W.
R. 7 W.
T. 75 N.
(Joins sheet 53)
(Joins sheet 59)
(Joins sheet 61)
(Joins sheet 67)
(68)
West Fork
Crooked Creek
Cedar Creek
25
26
29
30
31
32
35
36

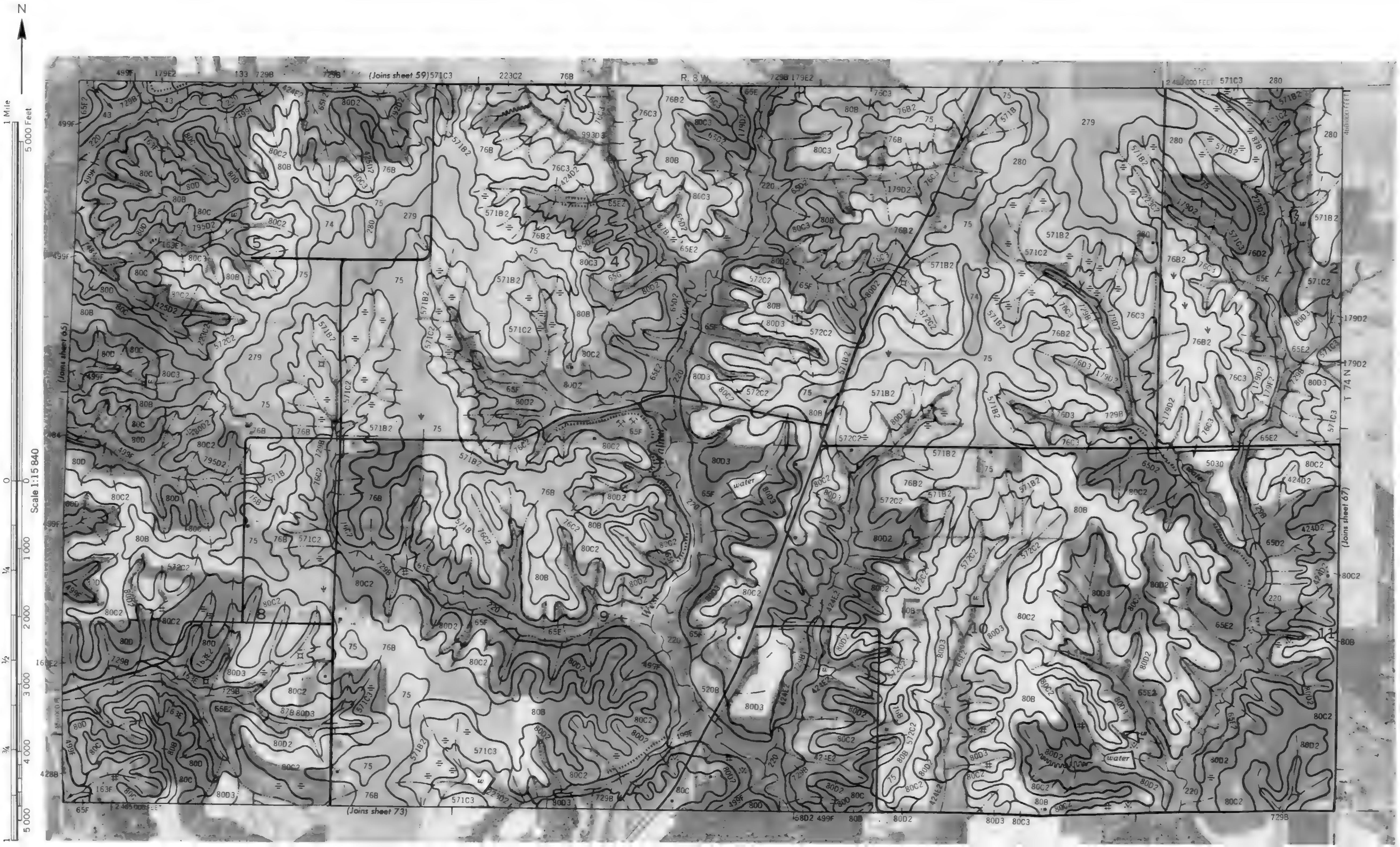

61
N
(Joins sheet 54)
(Joins sheet 62)
(Joins sheet 68)
(Joins sheet 60)
R. 7 W.
T. 75 N.
CITY OF WASHINGTON AIRPORT
BURLINGTON NORTHERN
CHICAGO ROCK ISLAND AND PACIFIC
water
27
28
26
25
33
34
35
36
1 Mile
5 000 Feet
Scale 1:15 840

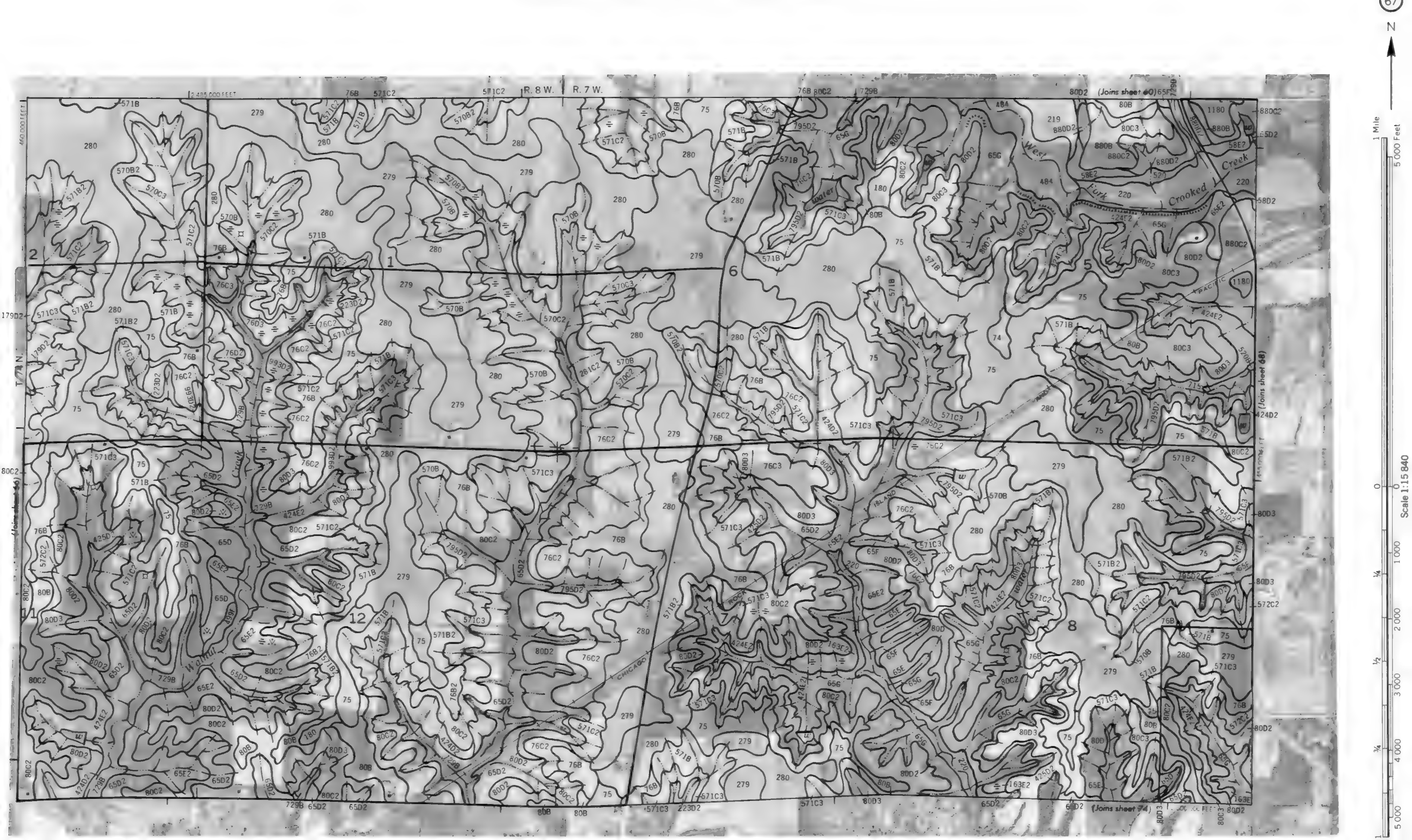

N
1 Mile
5 000 Feet
Scale 1:15 840
R. 7 W.
R. 6 W.
(Joins sheet 55)
(Joins sheet 61)
(Joins sheet 63)
(Joins sheet 69)
T. 75 N.
25
30
29
28
36
31
32
33
CHICAGO ROCK ISLAND AND
Big Slough Creek
South Fork Creek
BURLINGTON NORTHERN
Havre

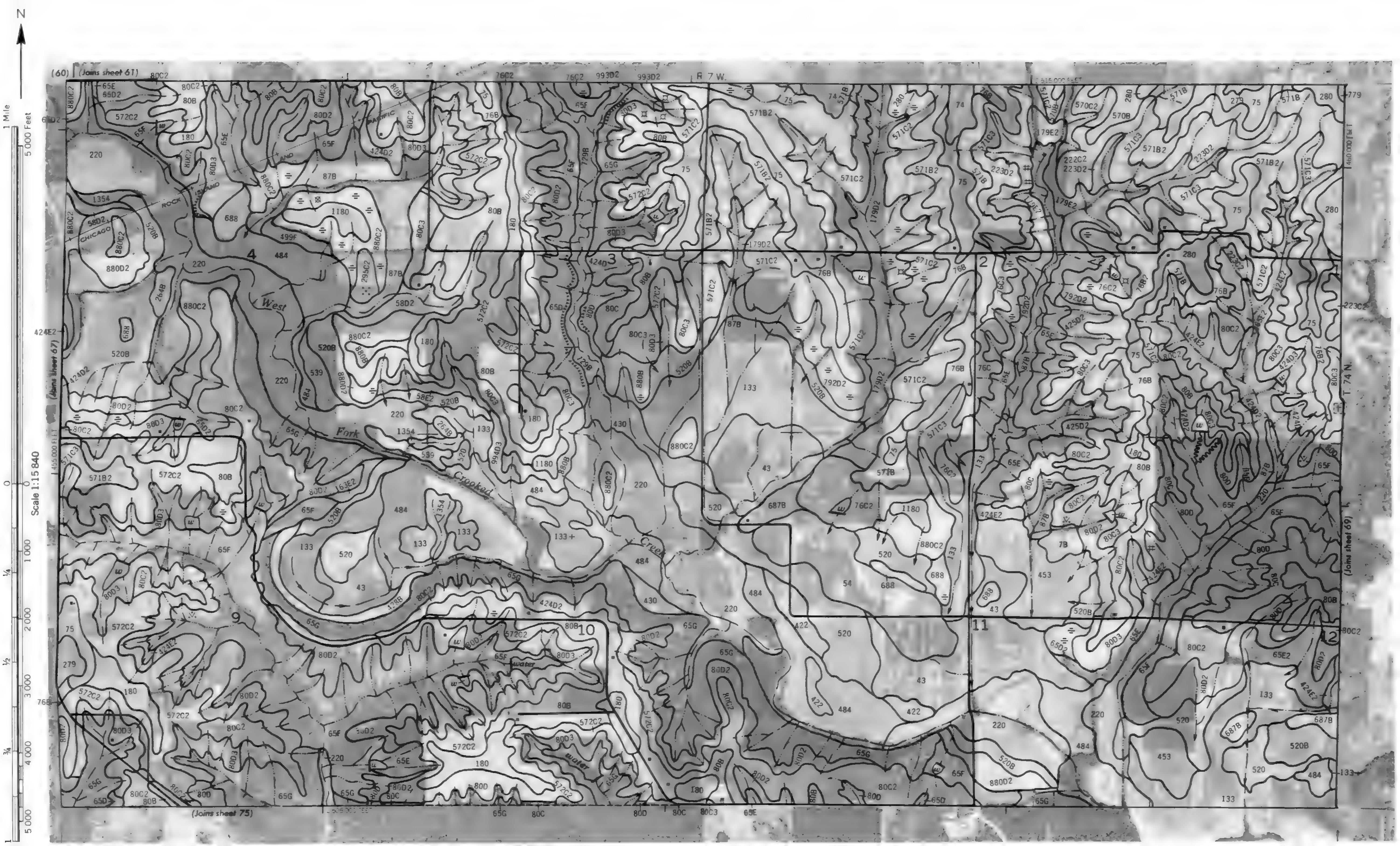

63
N
R. 6 W.
T. 75 N.
(Joins sheet 56)
(Joins sheet 62)
(Joins sheet 70)
LOUISA COUNTY
North Fork Long Creek
South Fork Long Creek
Long Creek
27
26
25
34
35
36
water
1 Mile
5 000 Feet
Scale 1:15 840
0
¼
½
¾
1 000
2 000
3 000
4 000
5 000

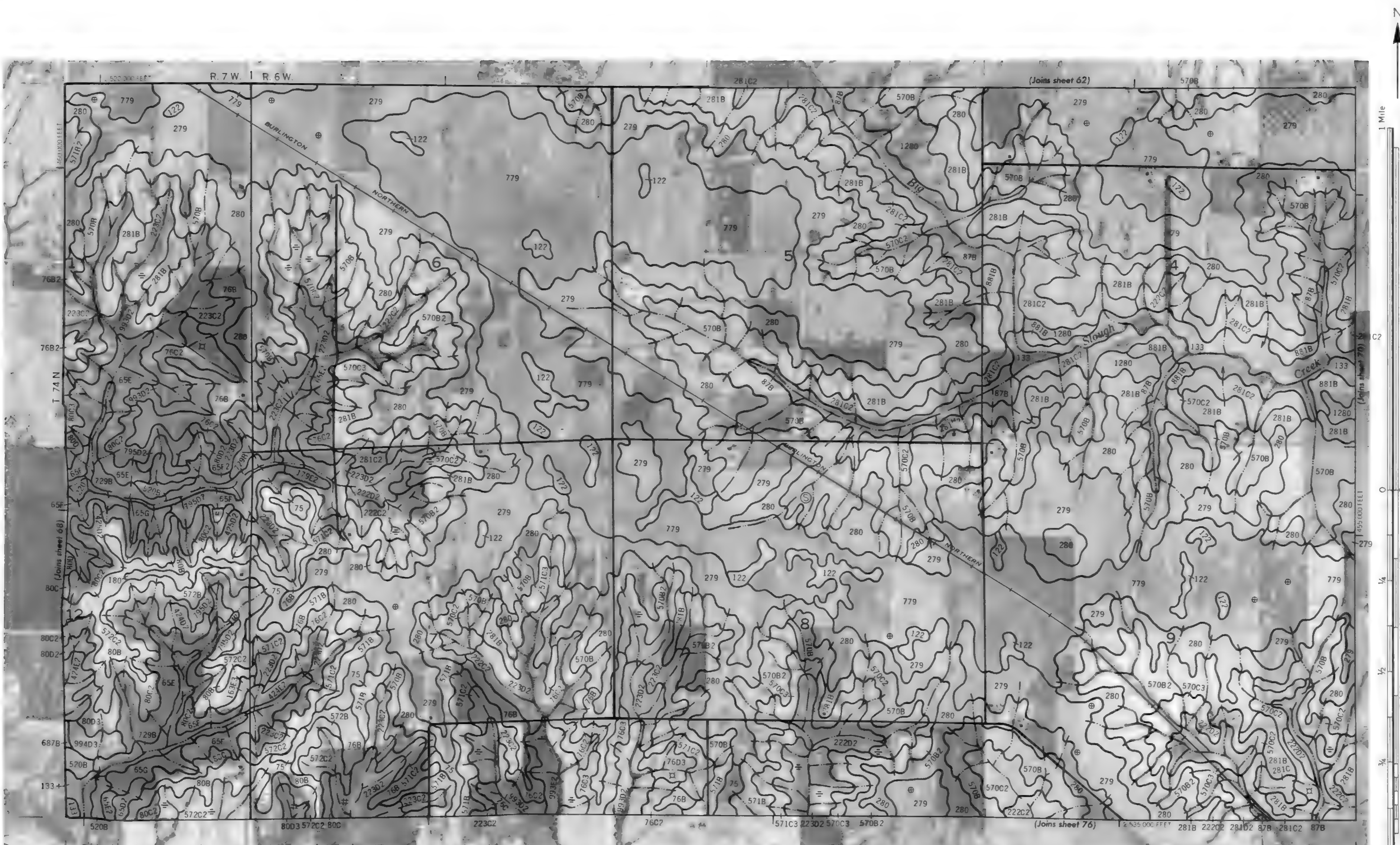
64
N
1 Mile
5 000 Feet
Scale 1:15 840
(Joins sheet 57)
R. 9 W.
(Joins sheet 65)
74 N.
(Joins sheet 71)
KEOKUK COUNTY
STATE OF IOWA WILDLIFE PRESERVE
SKUNK RIVER
SKUNK
RIVER
Dutch Creek
Richland Creek
Honey Creek
CHICAGO MILWAUKEE ST. PAUL AND PACIFIC
water

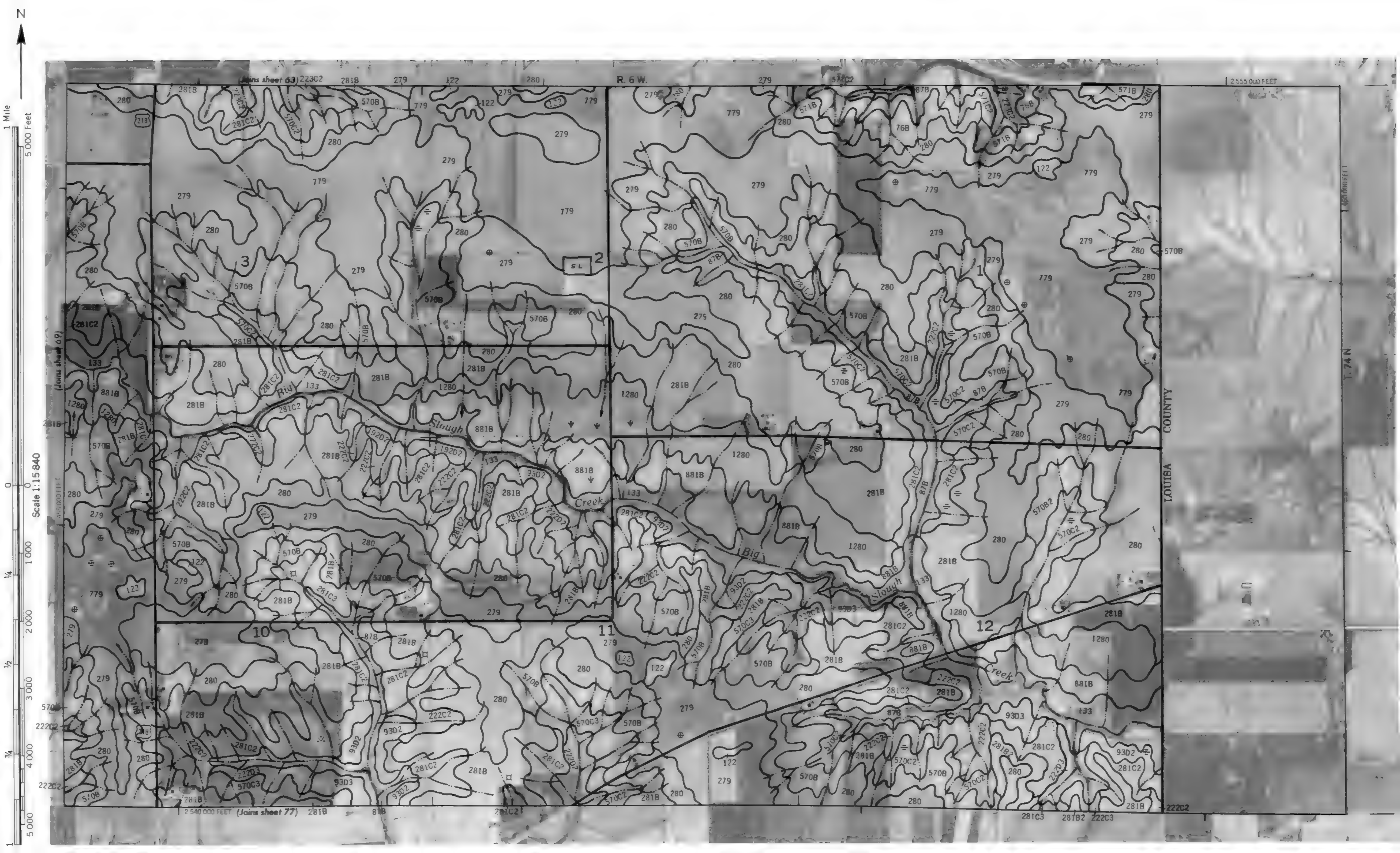

N
(Joins sheet 58)
(Joins sheet 64)
(Joins sheet 66)
(Joins sheet 72)
R. 9 W.
R. 8 W.
T. 74 N.
SKUNK RIVER
SKUNK RIVER
Indian Creek
Indian Creek
BRINTON TIMBER COUNTY PARK
MILWAUKEE
2 450 000 FEET
Scale 1:15 840
1 Mile
5 000 Feet

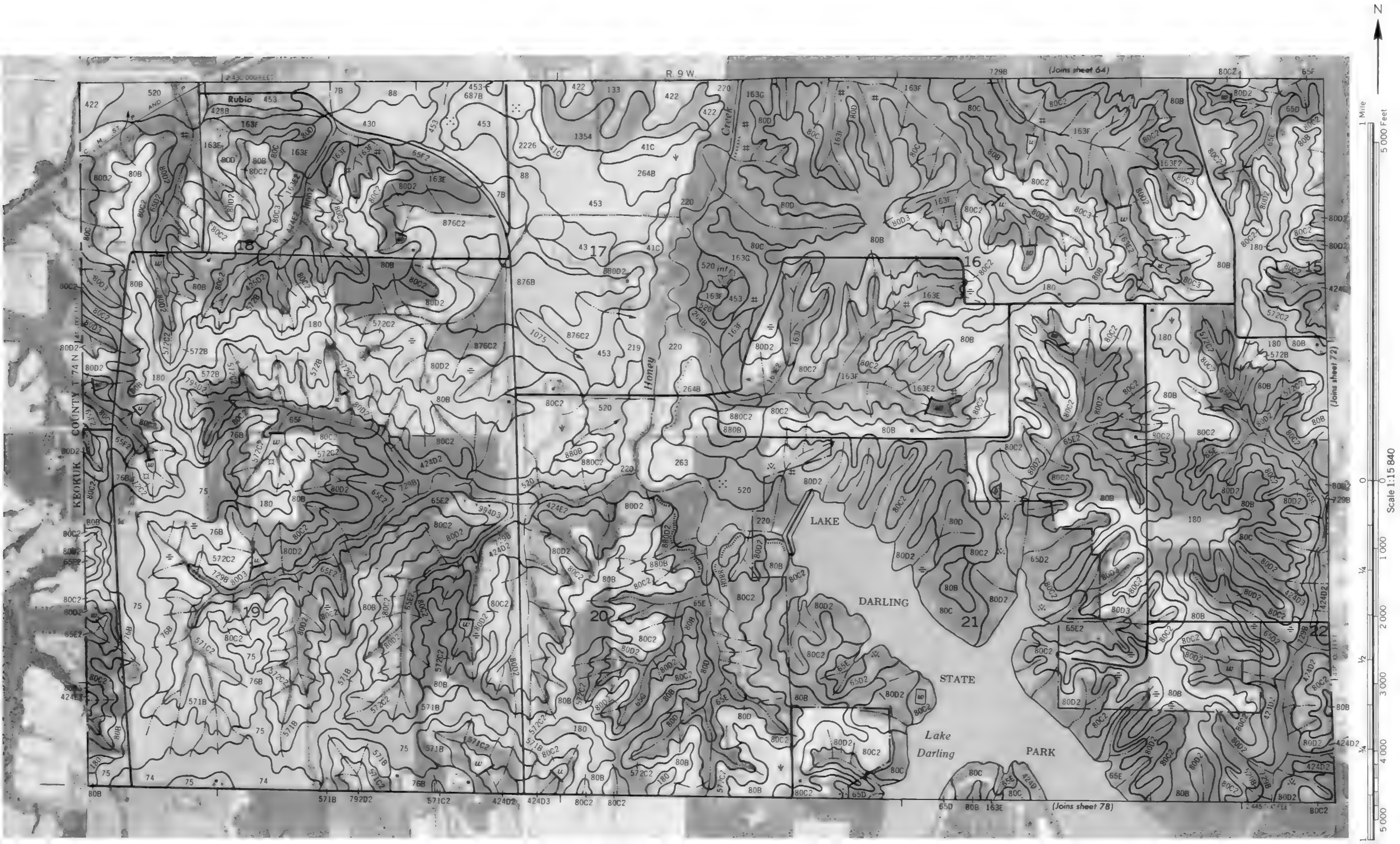

N
1 Mile
5 000 Feet
Scale 1:15 840
(Joins sheet 59)
(Joins sheet 65)
(Joins sheet 67)
(Joins sheet 73)
R. 8 W.
T. 74 N.
water

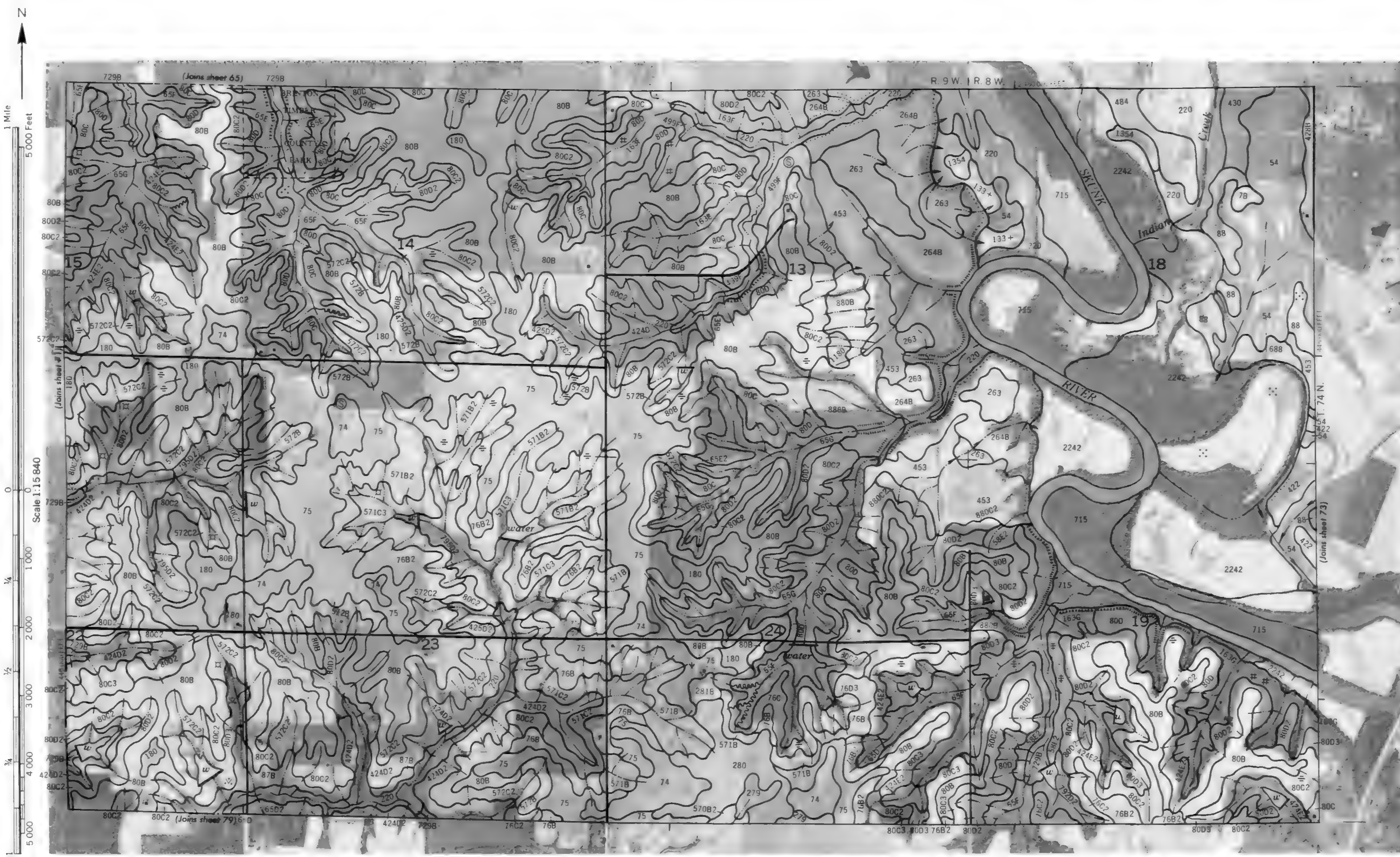

67
N
R. 8 W.
R. 7 W.
(Joins sheet 60)
(Joins sheet 68)
(Joins sheet 74)
West Fork Crooked Creek
Walnut Creek
Chicago Rock Island Pacific
1 Mile
5 000 Feet
Scale 1:15 840
0
1000
2000
3000
4000
5000


N
1 Mile
5 000 Feet
Scale 1:15 840
(60)
(Joins sheet 61)
(Joins sheet 67)
(Joins sheet 69)
(Joins sheet 75)
R 7 W.
T. 74 N.
CHICAGO ROCK ISLAND AND PACIFIC
West Fork Crooked Creek
water
4
3
2
9
10
11
12


N
R. 7 W.
R. 6 W.
T 74 N
BURLINGTON
NORTHERN
(Joins sheet 62)
(Joins sheet 76)
(Joins sheet 68)
(Joins sheet 70)
Big
Slough
Creek
1 Mile
5 000 Feet
Scale 1:15 840
0
1 000
2 000
3 000
4 000
5 000

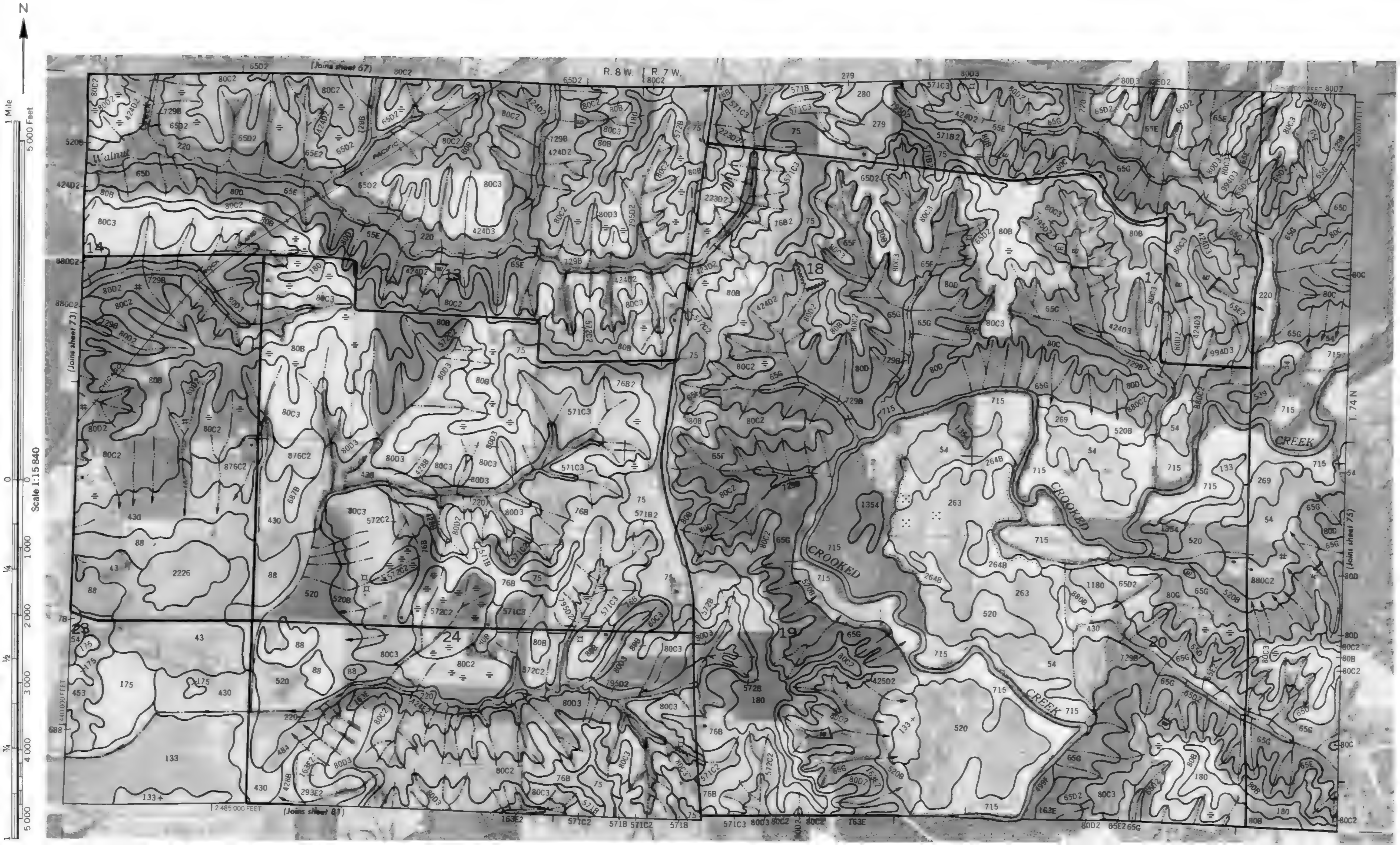

N
1 Mile
5 000 Feet
Scale 1:15 840
R. 6 W.
T. 74 N.
LOUISA COUNTY
(Joins sheet 63)
(Joins sheet 69)
(Joins sheet 77)
2 555 000 FEET
2 540 000 FEET
Big Slough Creek
Big Slough Creek
3
2
1
10
11
12
SL


N
R. 9 W.
2 430 000 FEET
(Joins sheet 64)
(Joins sheet 72)
(Joins sheet 78)
KEOKUK COUNTY
T. 74 N.
Rubio
C. M. ST. P. AND P.
Honey
Creek
LAKE
DARLING
STATE
PARK
Lake
Darling
15
16
17
18
19
20
21
22
1 Mile
5 000 Feet
Scale 1:15 840
0
1/4
1/2
3/4
1 000
2 000
3 000
4 000
5 000

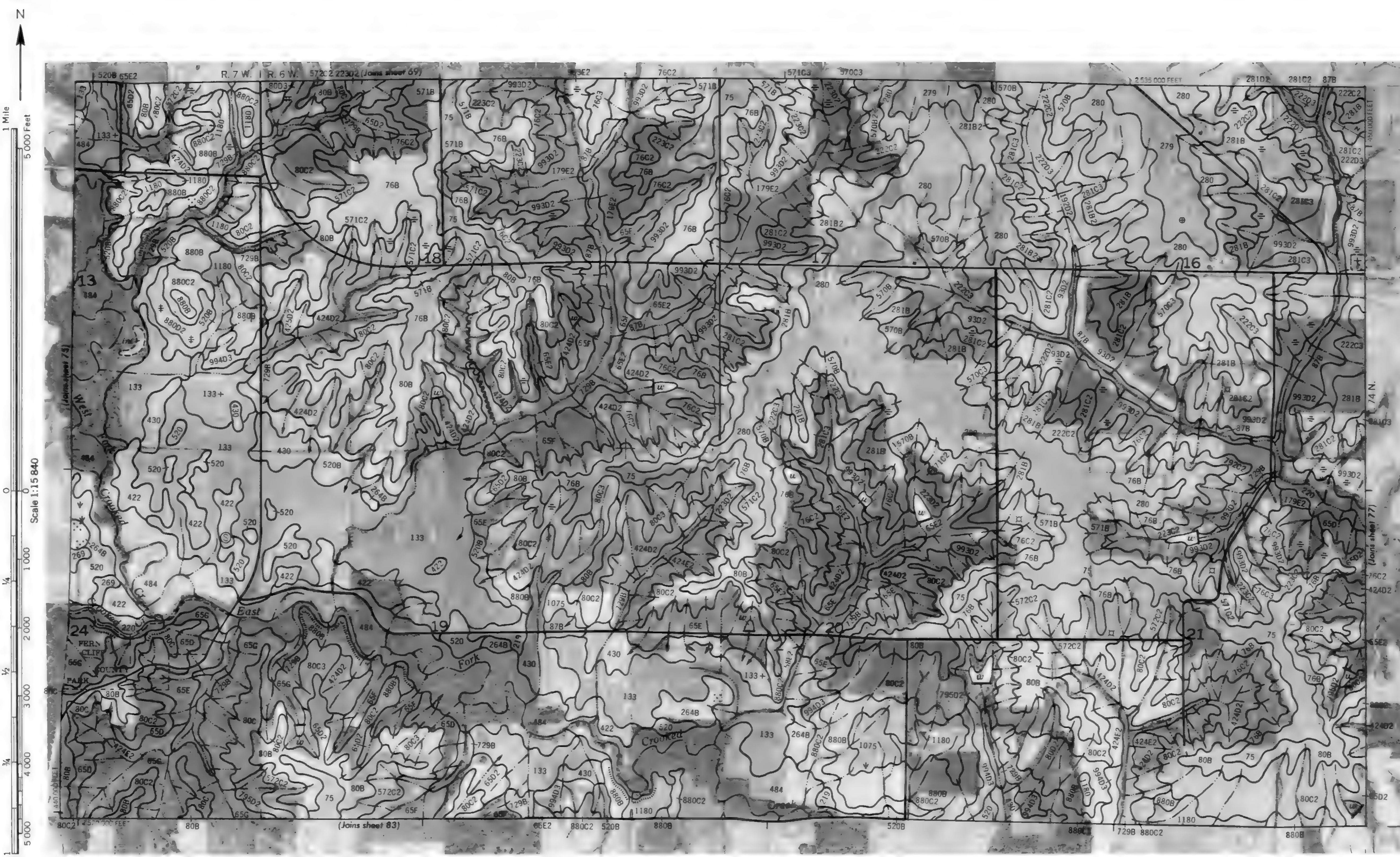

N
1 Mile
5 000 Feet
Scale 1:15 840
(Joins sheet 65)
R. 9 W. | R. 8 W.
BRENTON TIMBER COUNTY PARK
SKUNK RIVER
Indian Creek
T. 74 N.
(Joins sheet 73)
(Joins sheet 79)
water
14
13
18
15
23
24
19

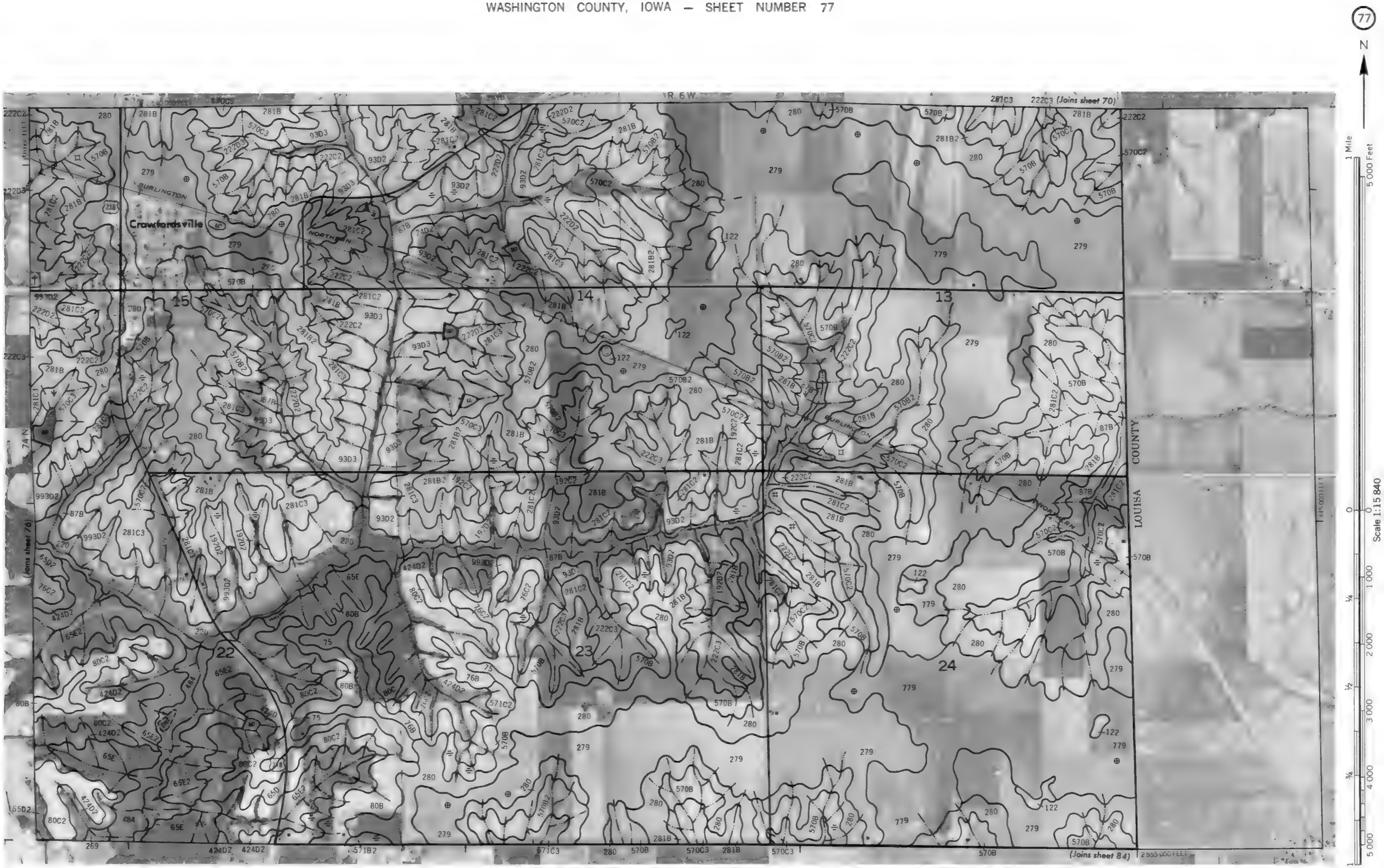

N
(Joins sheet 66)
(Joins sheet 72)
(Joins sheet 74)
(Joins sheet 80)
R. 8 W.
West Walnut Creek
Walnut Creek
SKUNK RIVER
water
CHICAGO ROCK ISLAND AND PACIFIC
16
17
15
14
20
21
22
23
1 Mile
5 000 Feet
Scale 1:15 840

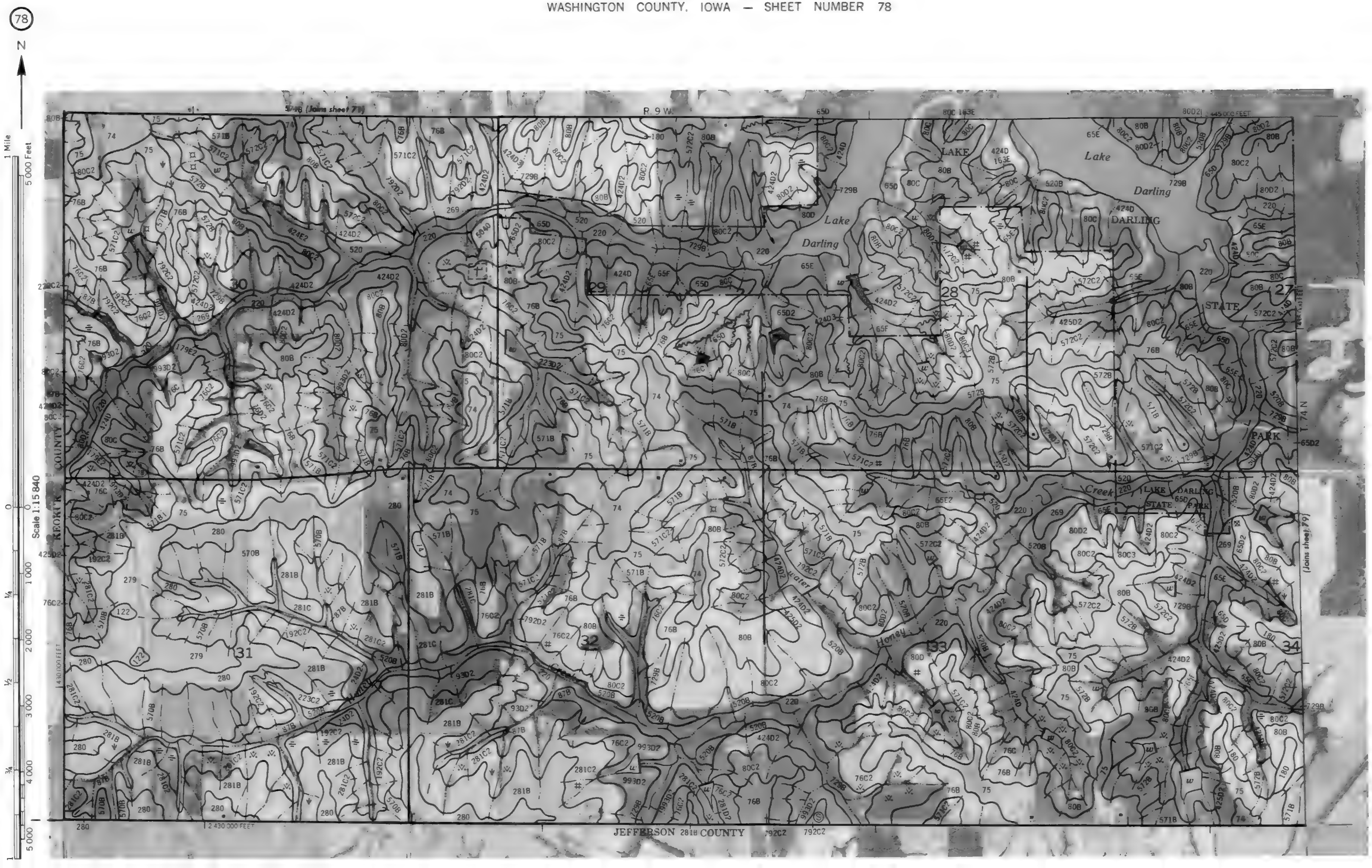
WASHINGTON COUNTY, IOWA — SHEET NUMBER 74

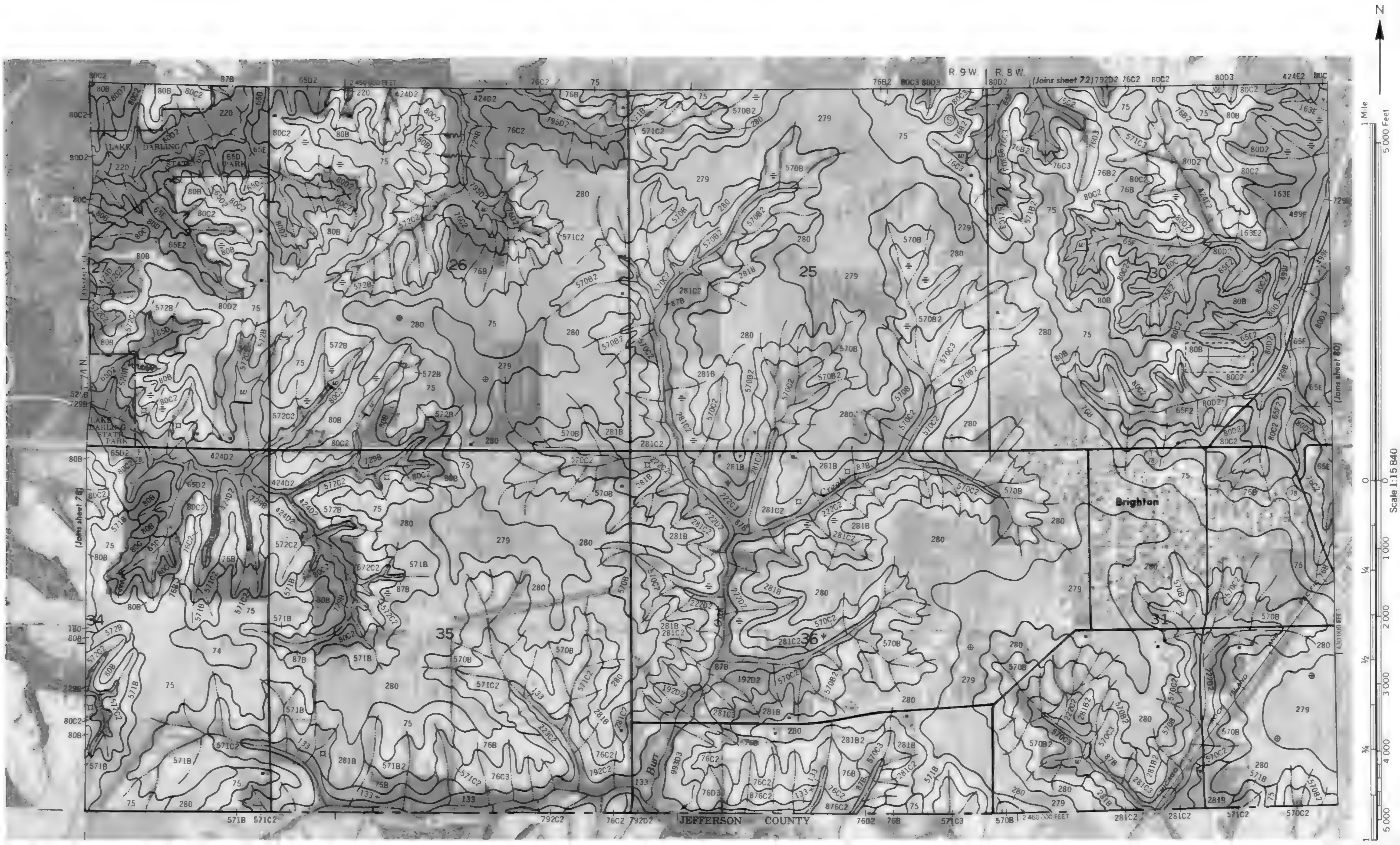


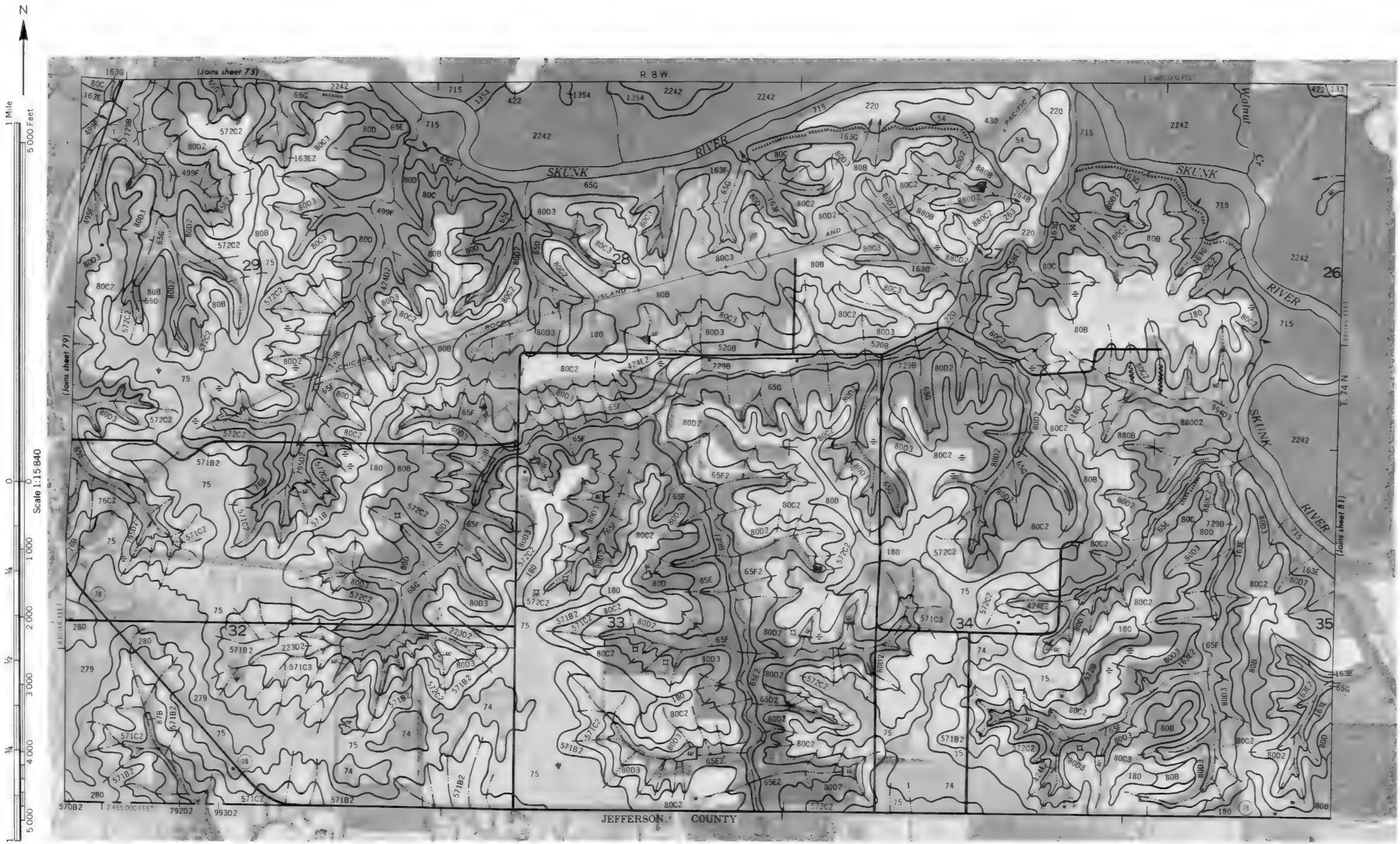

N
SOCKUM RIDGE COUNTY PARK
CROOKED CREEK
Crooked Creek
West Fork Crooked Cr
FERN CLIFF CO PARK
R 7 W
T 74 N
(Joins sheet 68)
(Joins sheet 74)
(Joins sheet 76)
(Joins sheet 82)
1 Mile
5 000 Feet
Scale 1:15 840

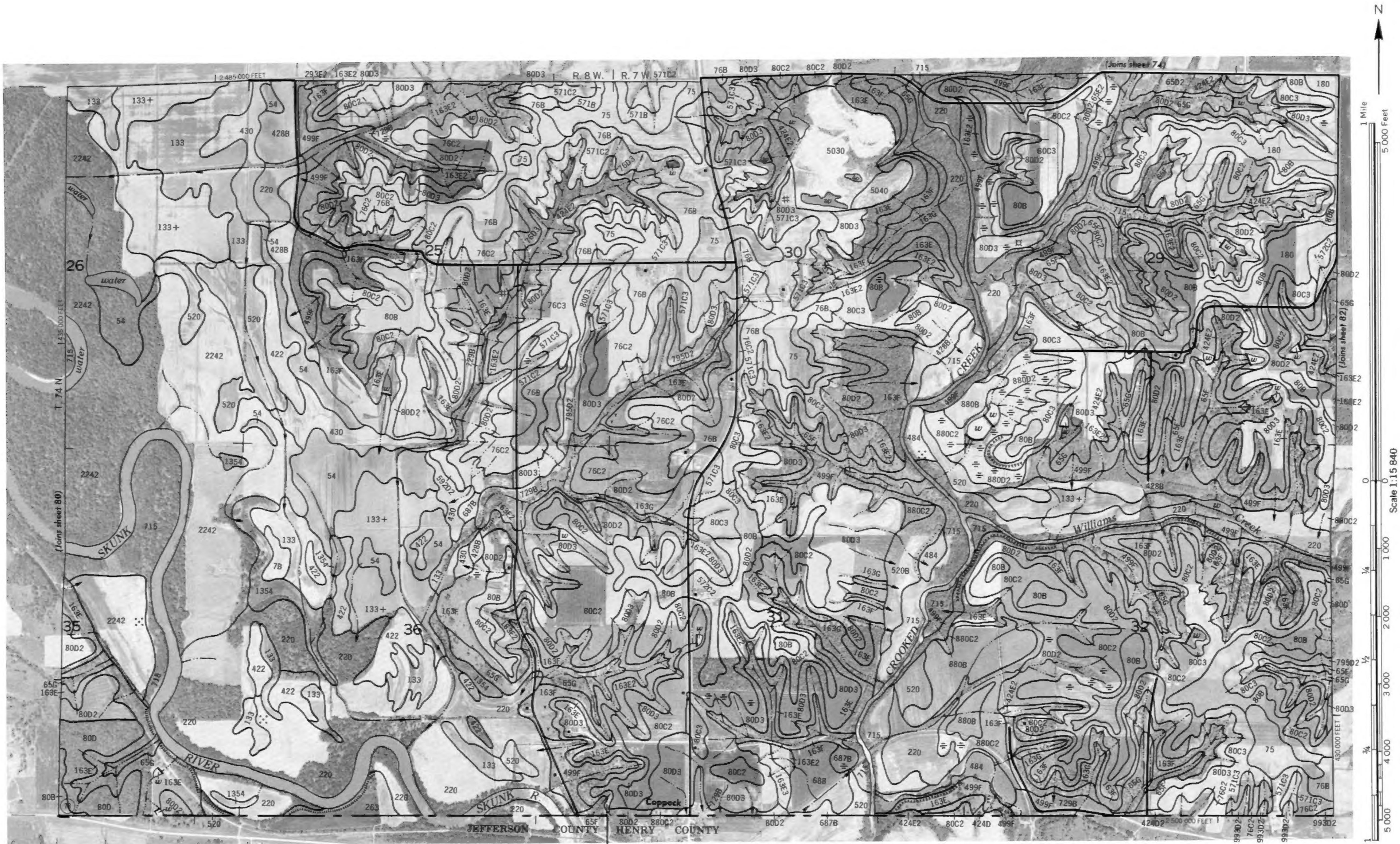

N
1 Mile
5 000 Feet
Scale 1:15 840
R. 7 W. | R. 6 W.
(Joins sheet 69)
(Joins sheet 83)
(Joins sheet 77)
(Joins sheet 75)
T. 74 N.
2 535 000 FEET
West Fork
Crooked Creek
East Fork
Crooked
FERN CLIFF COUNTY PARK
13
16
17
18
19
20
21
24

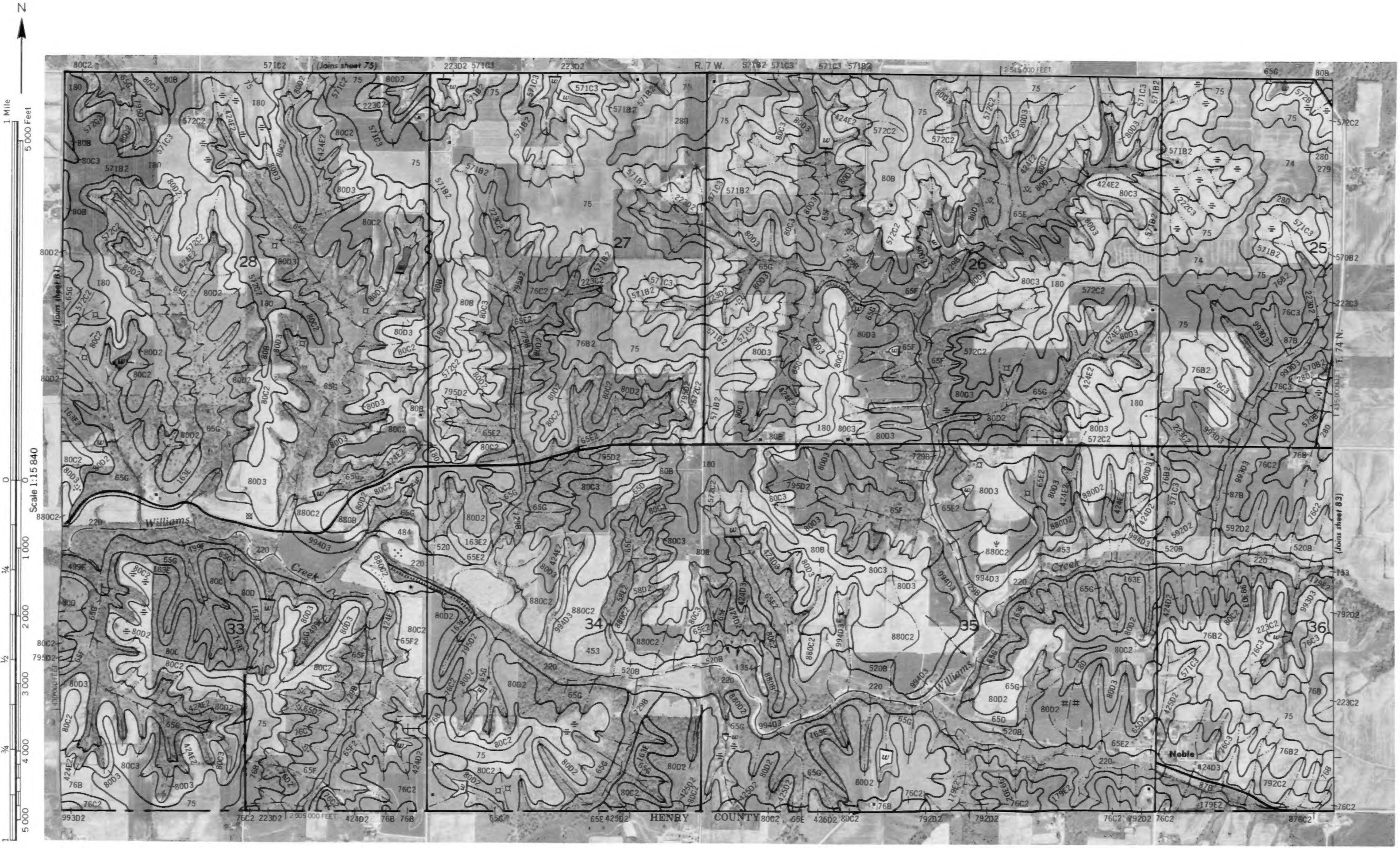

77
N
R. 6 W.
222C3 (Joins sheet 70)
(Joins sheet 76)
(Joins sheet 84)
Crawfordsville
BURLINGTON
NORTHERN
74 N.
LOUISA
COUNTY
15
14
13
22
23
24
Scale 1:15 840
1 Mile
5 000 Feet
0
1 000
2 000
3 000
4 000
5 000
¼
½
¾
1

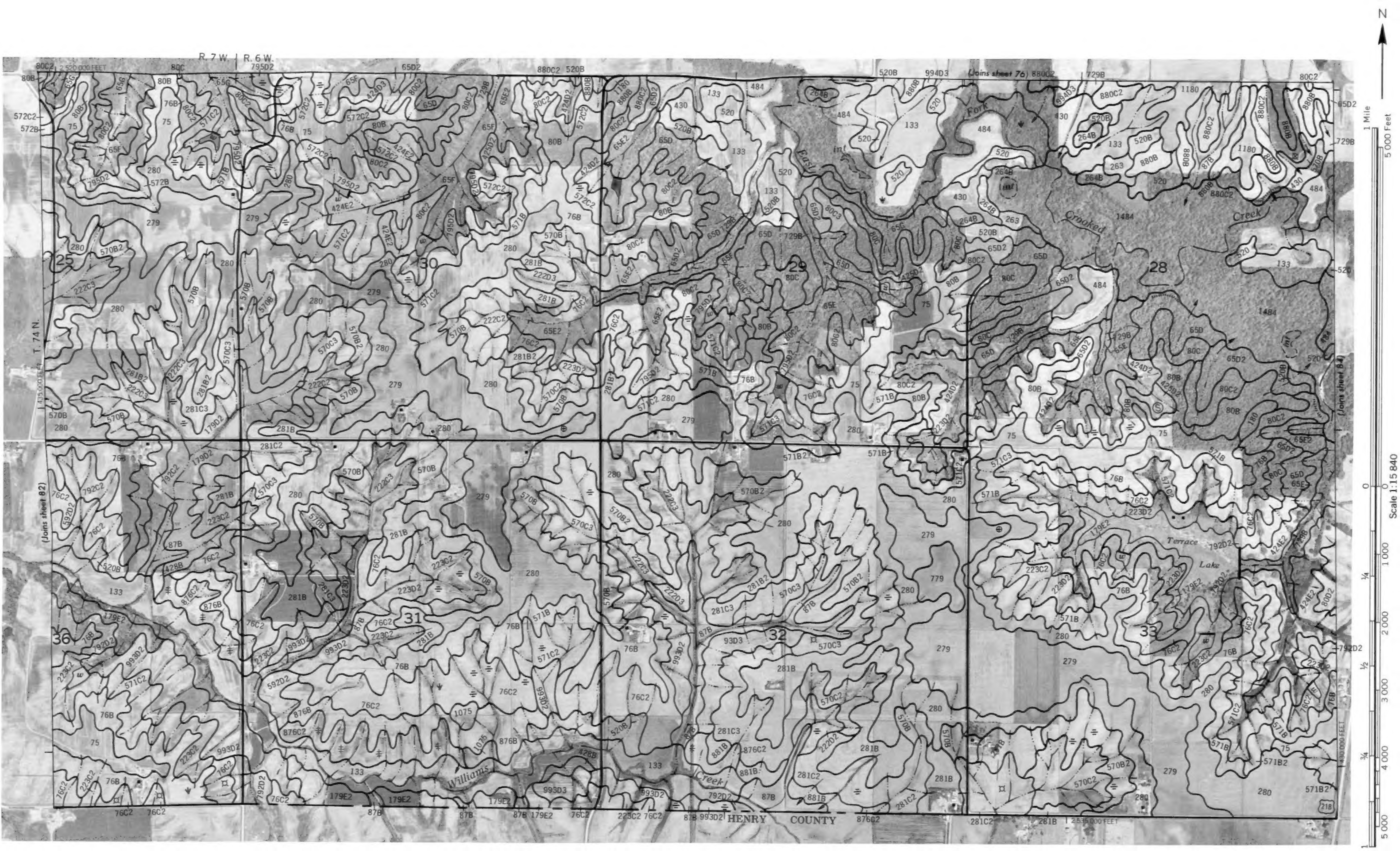

78
N
Lake Darling
LAKE DARLING STATE PARK
Honey Creek
KEOKUK COUNTY
JEFFERSON COUNTY
R. 9 W.
T. 74 N.
(Joins sheet 71)
(Joins sheet 79)
Scale 1:15 840
1 Mile
5 000 Feet
2 430 000 FEET
27
28
29
30
31
32
33
34

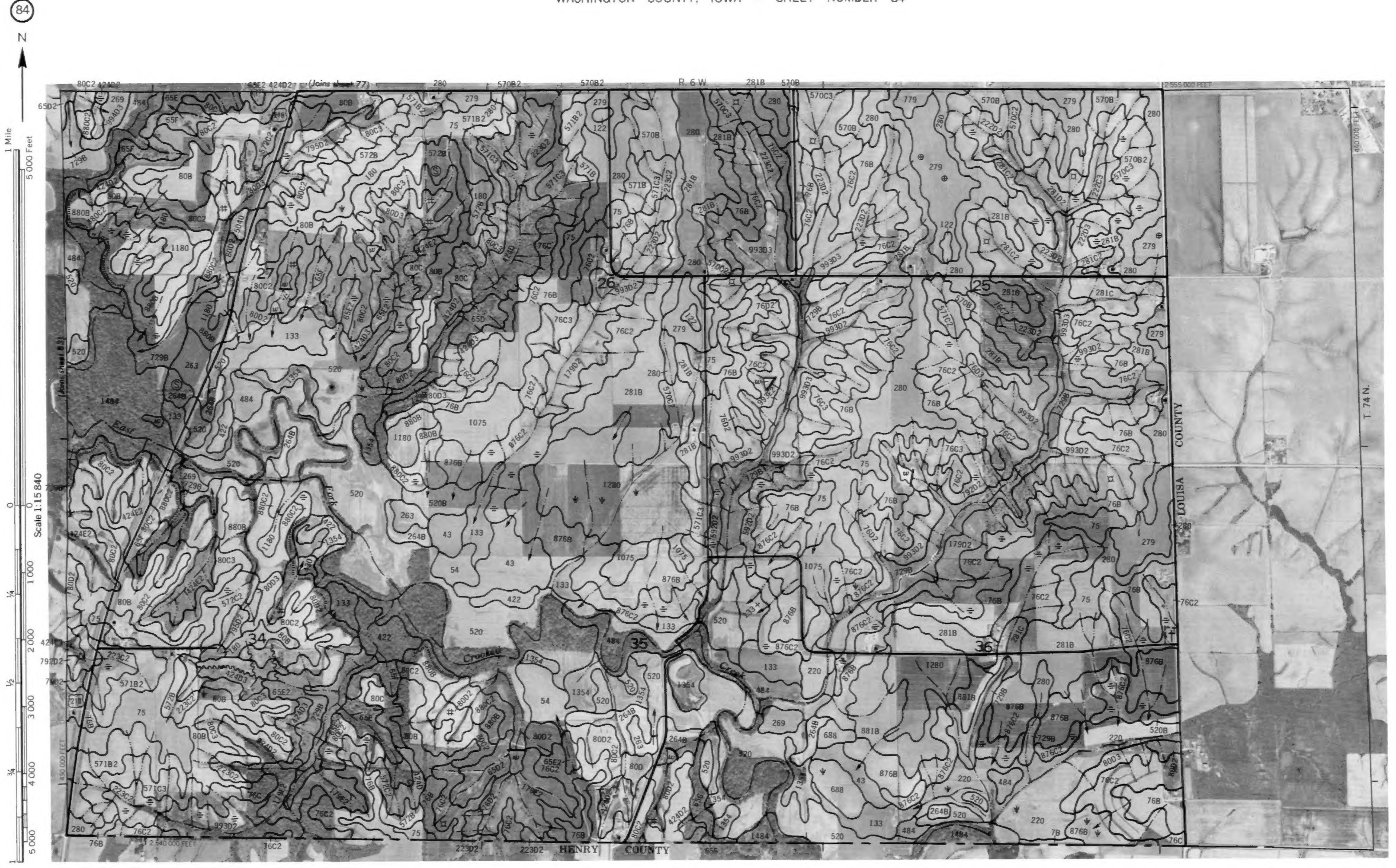

N
R. 9 W.
R. 8 W.
(Joins sheet 72)
(Joins sheet 80)
(Joins sheet 78)
LAKE DARLING STATE PARK
T. 74 N.
Brighton
JEFFERSON COUNTY
2 450 000 FEET
2 460 000 FEET
430 000 FEET
25
26
30
31
34
35
36
1 Mile
5 000 Feet
Scale 1:15 840


N
1 Mile
5 000 Feet
Scale 1:15 840
(Joins sheet 73)
R. 8 W.
SKUNK RIVER
Walnut Cr.
CHICAGO ROCK ISLAND AND PACIFIC
(Joins sheet 79)
(Joins sheet 81)
T. 74 N.
26
27
28
29
32
33
34
35
JEFFERSON COUNTY


N
(Joins sheet 74)
(Joins sheet 80)
(Joins sheet 82)
R. 8 W.
R. 7 W.
T. 74 N.
2 485 000 FEET
435 000 FEET
2 500 000 FEET
430 000 FEET
26
25
30
29
35
36
31
32
water
SKUNK
RIVER
SKUNK R.
CROOKED
CREEK
Williams
Creek
Coppock
JEFFERSON COUNTY
HENRY COUNTY
1 Mile
5 000 Feet
Scale 1:15 840


N
1 Mile
5 000 Feet
Scale 1:15 840
(Joins sheet 75)
(Joins sheet 81)
(Joins sheet 83)
R. 7 W.
T. 74 N.
Williams Creek
HENRY COUNTY
Noble
28
27
26
25
33
34
35
36


N
R. 7 W. | R. 6 W.
T. 74 N.
(Joins sheet 76)
(Joins sheet 82)
(Joins sheet 84)
HENRY COUNTY
East Fork
Crooked Creek
Williams Creek
Terrace Lake
25
28
29
30
31
32
33
36
1 Mile
5 000 Feet
Scale 1:15 840


84
N
1 Mile
5 000 Feet
Scale 1:15 840
(Joins sheet 77)
R. 6 W.
T. 74 N.
LOUISA COUNTY
HENRY COUNTY
East Fork
Crooked Creek
27
26
25
34
35
36